TACTICIAN
T1000

Reference manual & User guide

T1000 v5/1 Compatibility

Please note

T1000 v5/1 is a direct replacement for T1000 v3/2 onwards (referred to as 3/x below) and is upward-compatible in all respects except for TAN, which is no longer supported. All other databases configured for v3/x should run on v5/1. v3/x strategies should be loaded into the v5/1 control configurator, and, if appropriate, the sequence configurator, and saved before being run. Backups should be made first.

All features that were present in v3/7 are included, with the exception of the TAN blocks.
Explicit T640 support (e.g. root block, T640 I/O blocks, discrete control blocks, etc.) is not included.

T1000 v5/1 can be used to configure the following instruments provided that care is taken to ensure that only compatible features are used: T1000 v3/x, T100 v3/x, T231 v4/x, and T1000 v5/1.

Issue 5/A June 1994 Part Number HA 080 194 U004

ISSUE STATUS OF THIS MANUAL

Section	Issue
Title page	5/A
Contents	5/A
Chapter 1	5/A
Chapter 2	5/A
Chapter 3	5/A
Chapter 4	5/A
Chapter 5	5/A
Chapter 6	5/A
Chapter 7	5/A
Chapter 8	5/A
Chapter 9	5/A
Chapter 10	5/A
Chapter 11	5/A
Chapter 12	5/A
Chapter 13	5/A
Glossary	5/A
Index	5/A

Notes

1. Sections are up-dated independently and so may be at different issues.
2. The Title page, and the manual as a whole, always take the issue number of the most recently up-issued section.
3. Within a section, some pages in this manual may be at later issues than others. This happens if those pages have been individually up-issued and retro-fitted into the existing manual to bring it up-to-date — *a policy followed by Eurotherm Process Automation Limited to save paper and minimise harm to the environment*. However, the issue number of the whole section — as listed in the above table — is always the issue number of the most recently up-issued page(s) in that section.

CONTENTS

page

page

Chapter 1

INTRODUCTION

Tactician T1000 and the T100 Intelligent I/O System are major innovations in process plant unit control that enable a straightforward 'building-block' approach to be applied to control strategy design. They employ advanced industrially secure equipment with flexible and intelligent multichannel I/O devices allowing the hardware, the control strategy — and the risks — to be geographically distributed. Your operators and engineers will also appreciate the attractive and ergonomic high-resolution graphical stations provided by the system.

The T1000/T100 combination introduces a true masterless network, interconnecting to supervisory systems and the very successful Eurotherm Process Automation Network 6000 instrumentation. The result is a complete offering — from single-loop integrity to complex distributed multiple I/O configurations.

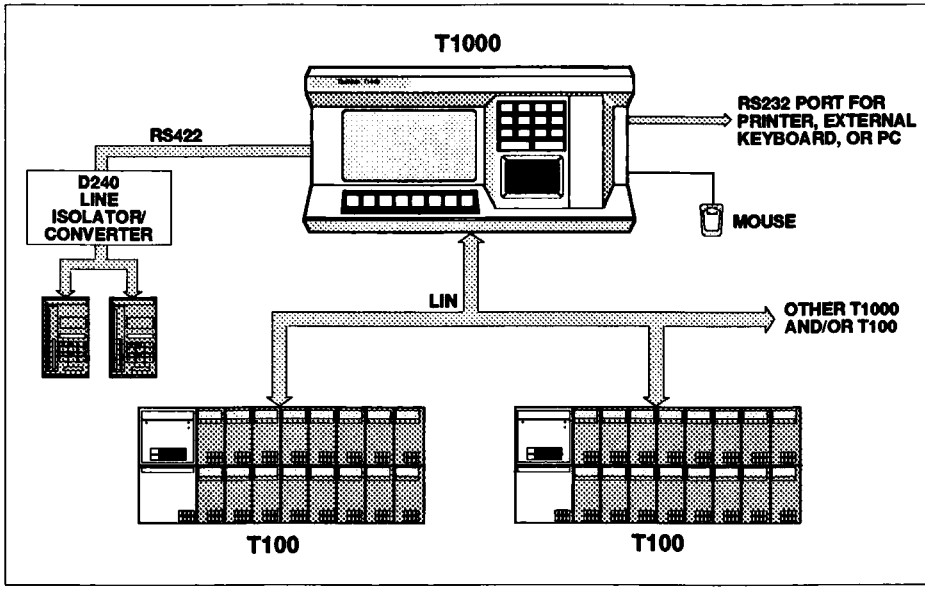


Figure 1.1 *T1000/T100 Network*

Using This Manual

Chapter 2 of this manual covers installation and wiring of the T1000, including safe mounting of the instrument to comply with standards.

Chapters 3 to 6 provide a guide to the T1000, in the form of an overview of all its facilities. These chapters should be read if you are new to T1000. They describe how to tailor the system for the tasks you require it to perform, and familiarise you with all the important operations without going into too much detail.

Chapters 7 to 11 are a comprehensive reference to all aspects of the 'user interface' — the T1000 front panel and power-up display, optional input devices, data entry, the runtime interface, and the control, graphic and utilities interfaces.

Chapter 12 deals with T1000 error messages and diagnostics, giving tables of error numbers and their meanings, and explains the structure of T1000 error numbering. Chapter 13 presents T1000's specifications and order codes.

At the end of the Manual, preceding the Index, you will find a Glossary of Terms used in the T1000 documentation, helpful to those who are new to this type of equipment or to Eurotherm Process Automation instrumentation in general.

Other Publications

If you have a Sequence option T1000, you should consult the *T1000/T100 Sequence Reference Manual & User Guide* (Part No. HA 080 194 U018, included in this binder) for details of the sequence interface.

You must refer to the *LIN Product Manual* (Part No. HA 082 375 U999) for details on all the LIN-based function blocks, their parameters and input/output connections. You will need this data to be able to select, interconnect, and parameterise the blocks in your control strategies. General information on installing, commissioning and using the LIN will also be found there.

How to use the PC-based LINtools database configurator to create control strategies — as an alternative to creating them in the T1000 itself — is described in the *T500 Product Manual* (Part No. HA 082 377 U999).

Chapter 2

INSTALLATION

T1000 Panel Mounting Instructions

The T1000 unit is fixed to the panel face by (up to) ten screw clamps, accessible from the rear. For IP66 operation all ten clamps must be used to ensure adequate compression of the integral gasket seal and full protection against vibration. For non-IP66 applications, *and where vibration will not be a problem*, fewer clamps can be used down to a minimum of four (two on each long side).

NOTE. To access the unit for servicing some clamps may have to be temporarily removed. Support the unit adequately during this operation.

When installing the T1000 you should leave enough space behind the unit to be able to see the diagnostics LED and allow the hinged door to open for maintenance.

To position a T1000 unit in a panel:

1. Insert the T1000 unit into a panel cut-out from the front of the panel. Figures 2.1 and 2.2 show the dimensions and panel cut-out details for the T1000.

2. If the panel is thin or of low-strength construction and liable to be distorted by the weight of the unit(s), reinforce it with a clamp frame (Part BE 082097). After inserting the T1000, slide the frame over the rear of the unit from the back of the panel. Figure 2.3 shows the clamp frame.

NOTE. To ensure an adequate seal for IP66 applications, mounting panels must be flat to within 0.4mm.

3. Locate the required number of clamps into the holes provided in the side plates.

4. Tighten the threaded bars with a screwdriver. The tip of the bar normally self-locates on the panel; if it wanders, centre-punch the panel to provide a positive location. For IP66 applications, tighten the clamps in two or three stages to a torque of 1Nm, in the sequence shown in Figure 2.4.

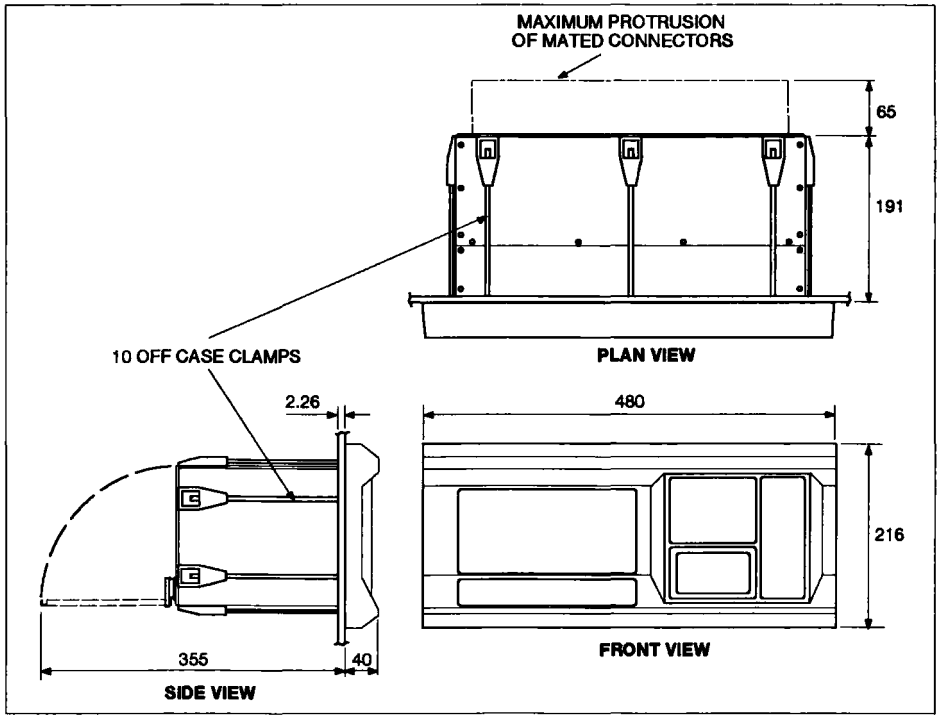


Figure 2.1 *T1000 Panel Mounting Dimensions*

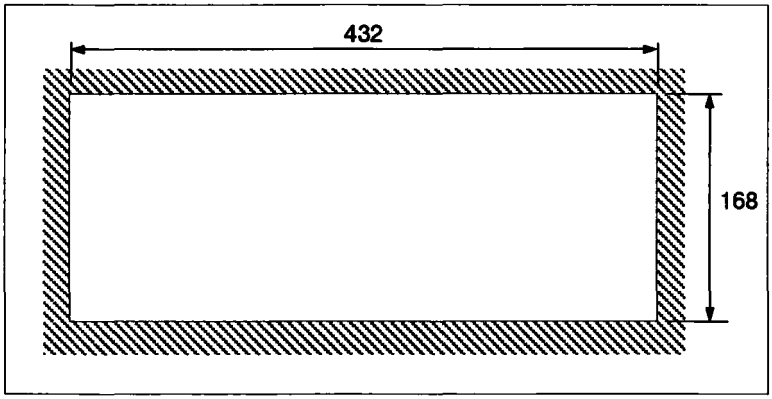


Figure 2.2 *T1000 Panel Cut-out Dimensions*

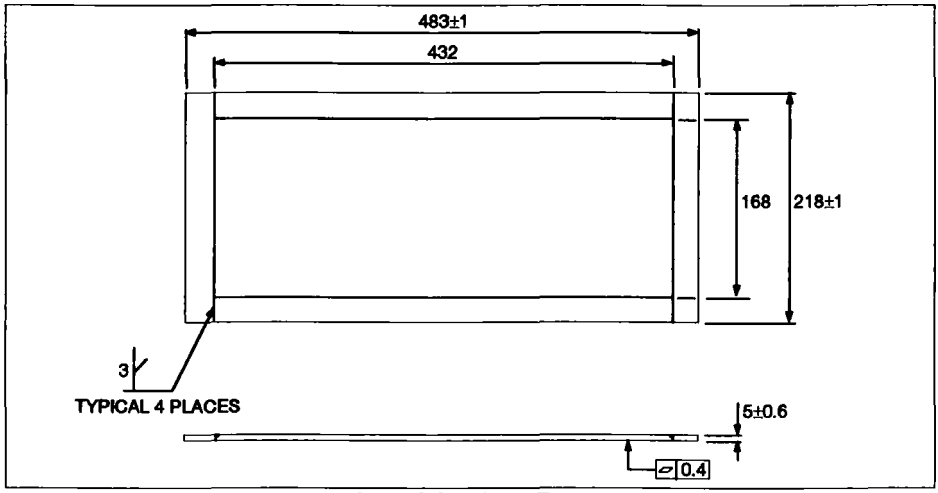


Figure 2.3 *Clamp Frame*

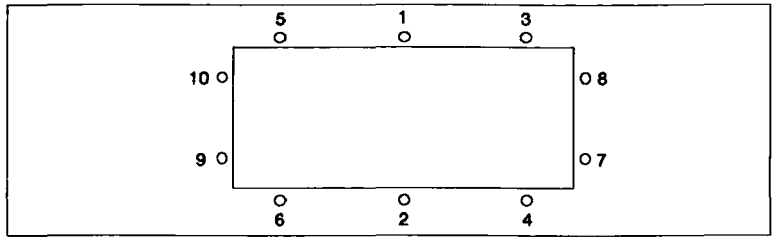
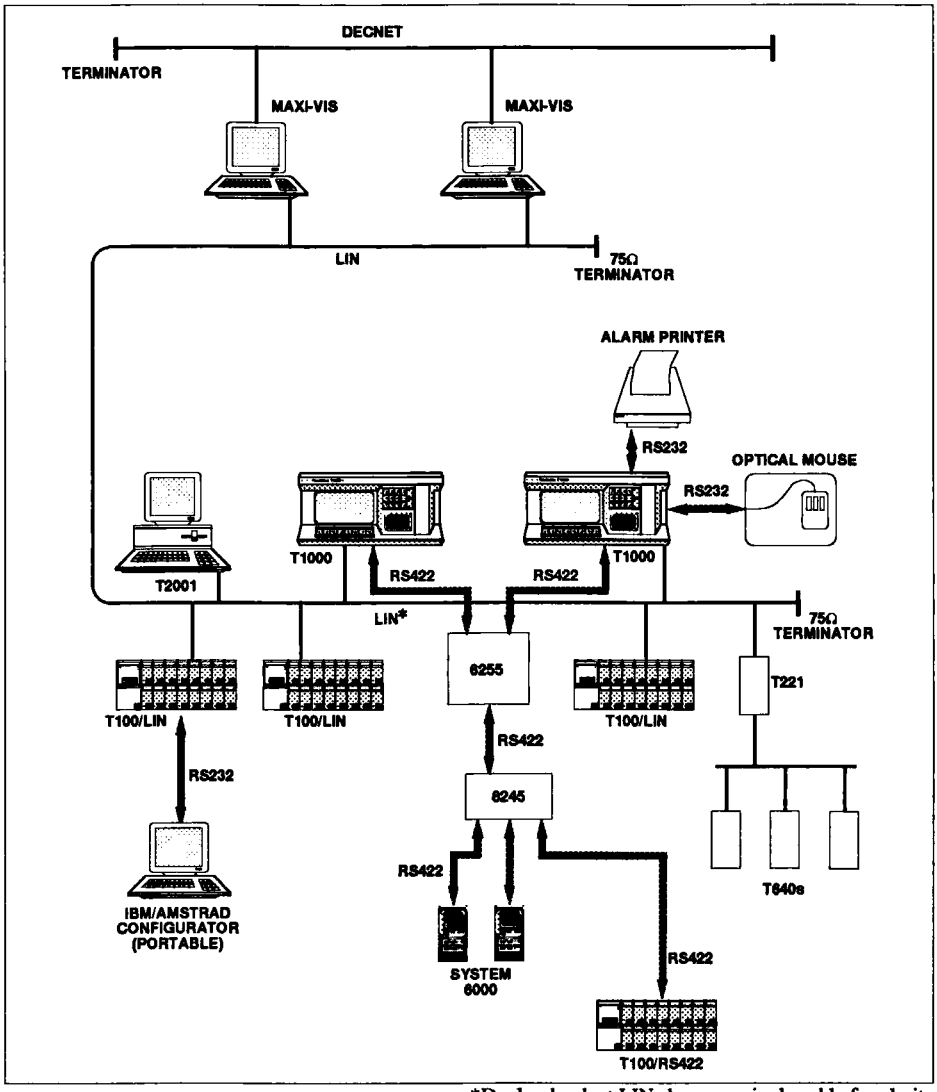


Figure 2.4 *Clamp Tightening Sequence*

Communications

Figure 2.5 schematises the overview of T1000 and T100 communications.



*Dual redundant LIN shown as single cable for clarity

Figure 2.5 *T1000/T100 Overview Schematic*

T1000 Communications & Signal Ground Schematics

Figures 2.6 and 2.7 show the T1000 communications ports and signal ground schematics. The system ground on RS232 inputs, zero volts on RS232 outputs, and zero volts on RS422 outputs are all internally connected to the chassis earth.

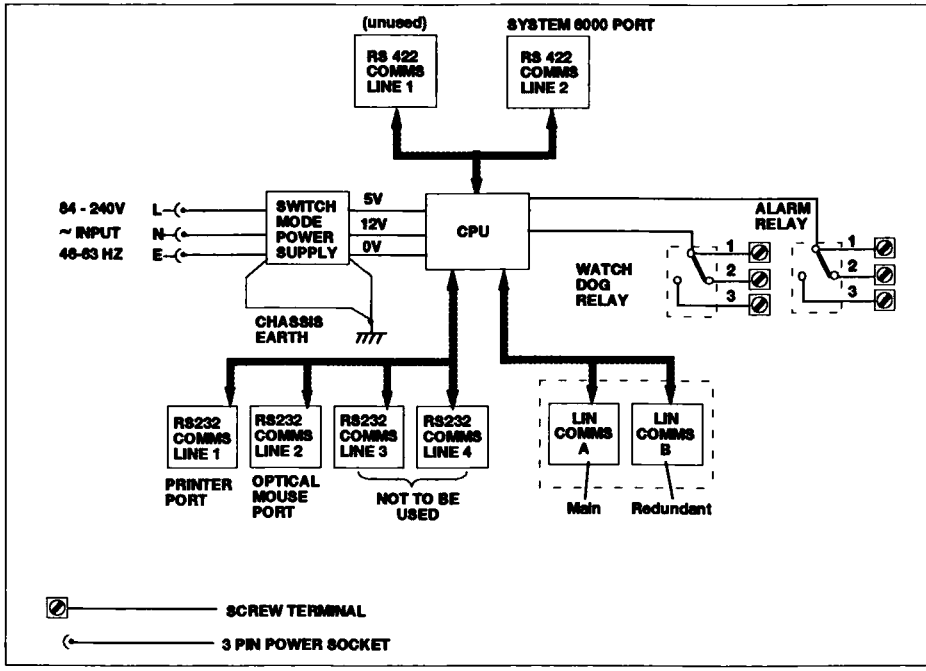


Figure 2.6 *T1000 Communications Ports Overview*

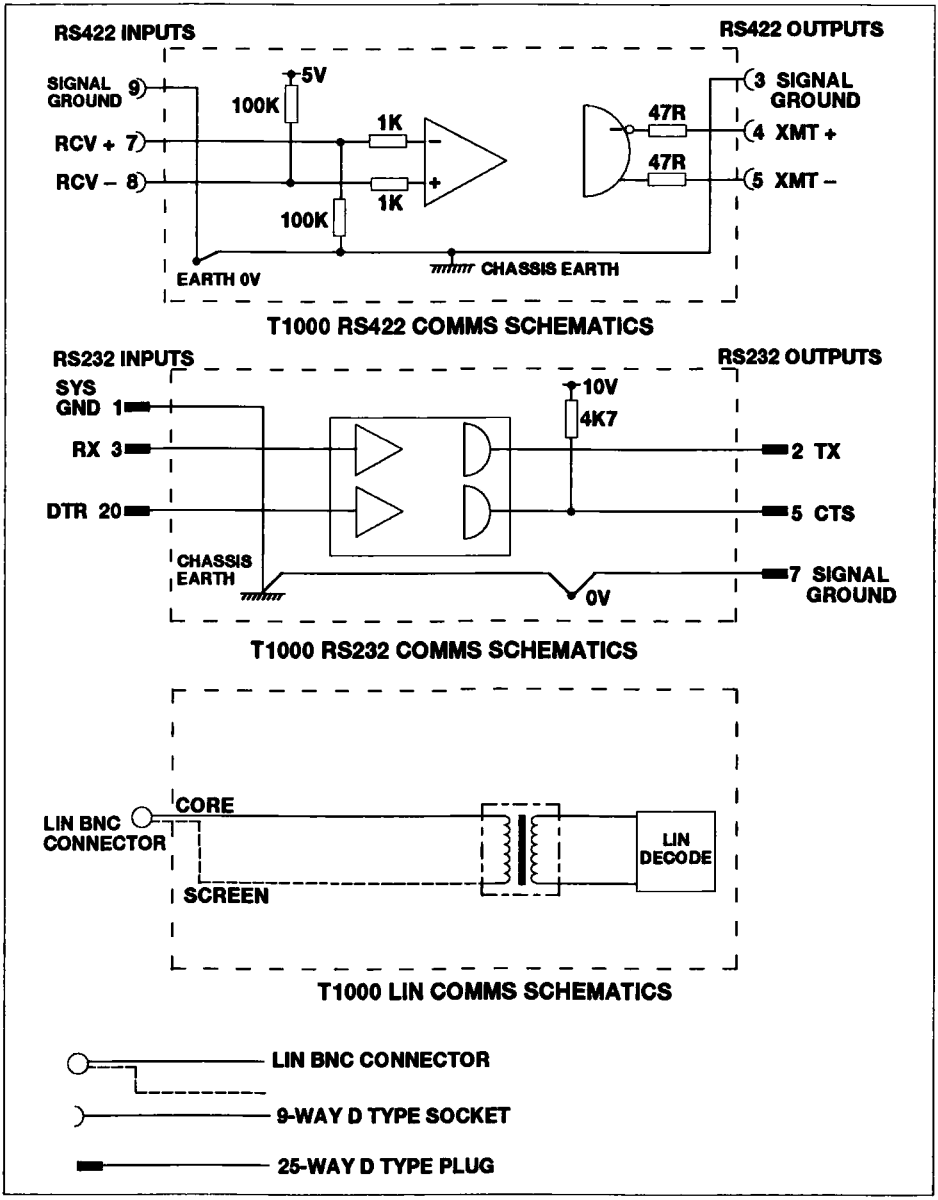


Figure 2.7 *T1000 Communications & Signal Ground Schematics*

T1000 Cables

Printer Cable

The EPSON LQ870 is recommended for use with the T1000. The printer connection cable (Part No. S9501-12) pin connections are shown in Figure 2.8.

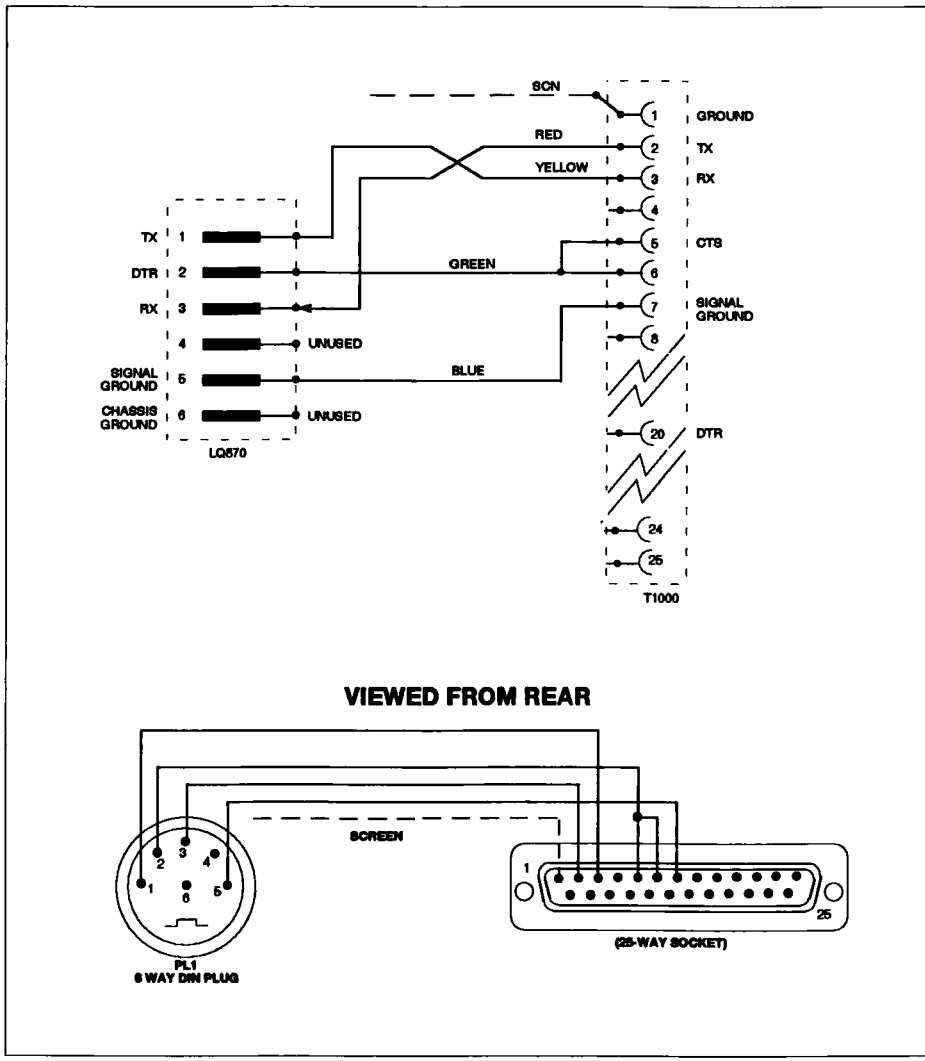


Figure 2.8 *Printer Cable Pin Connections*

For T1000 printouts the appropriate LQ850 and LQ870 switch settings and their meanings are given in Tables 2.1 and 2.2. Note that 'country' is always set to 'USA'.

Switchbank 1			Switchbank 2		
Switch	**State**	**Meaning**	**Switch**	**State**	**Meaning**
1	on	Country = USA	1	off	Page Length = 11"
2	on		2	off	1" Skip = Invalid
3	on		3	on	Interface =
4	on	CG Table = Graphic	4	on	Serial None
5	*(don't care)*		5	off	Baud Rate =
6	*(don't care)*		6	off	9600 BPS
7	off	CSF Mode = Invalid	7	off	Tear Off Mode = Invalid
8	off	Receive Buffer = 6Kb	8	off	Auto LF = Invalid

Table 2.1 *LQ850 Switch Settings*

Switchbank 1			Switchbank 2		
Switch	**State**	**Meaning**	**Switch**	**State**	**Meaning**
1	on	Country = USA	1	off	Page Length = 11"
2	on		2	off	
3	on		3	on	Tear Off Mode = on
4	on	CG Table = Graphic	4	off	Auto LF = invalid
5	on	Unidirectional			
6	*(don't care)*				
7	on	Receive buffer = off			
8	off	1" Skip = off			

Table 2.2 *LQ870 Switch Settings*

Optical Mouse 9/25-Way Adaptor

The optical mouse used with the T1000 requires a 9 to 25-way adaptor. Figure 2.9 shows the adaptor (Part No. CI081041) pin connections.

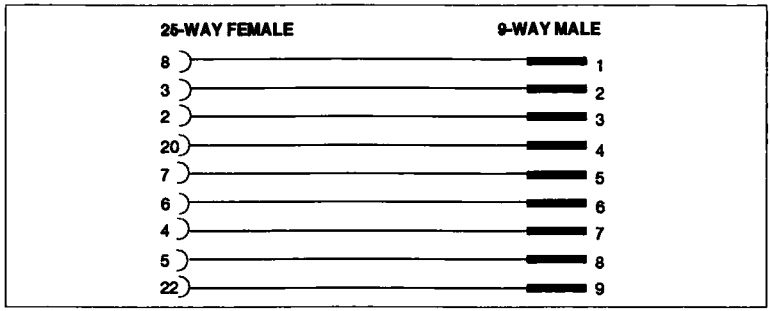


Figure 2.9 *Adaptor Pin Connections*

RS422 Cable Connections

Figure 2.10 shows the cable (Part No. S9502-6/HP option) pin connections for connecting a T1000 to a D240 (Communications Isolator) or to a peripheral (T100/RS422). Figure 2.11 shows the cable (Part No. S9502-6/PLFL option) pin connections for connecting a D240 Port B to a System 6000 bin.

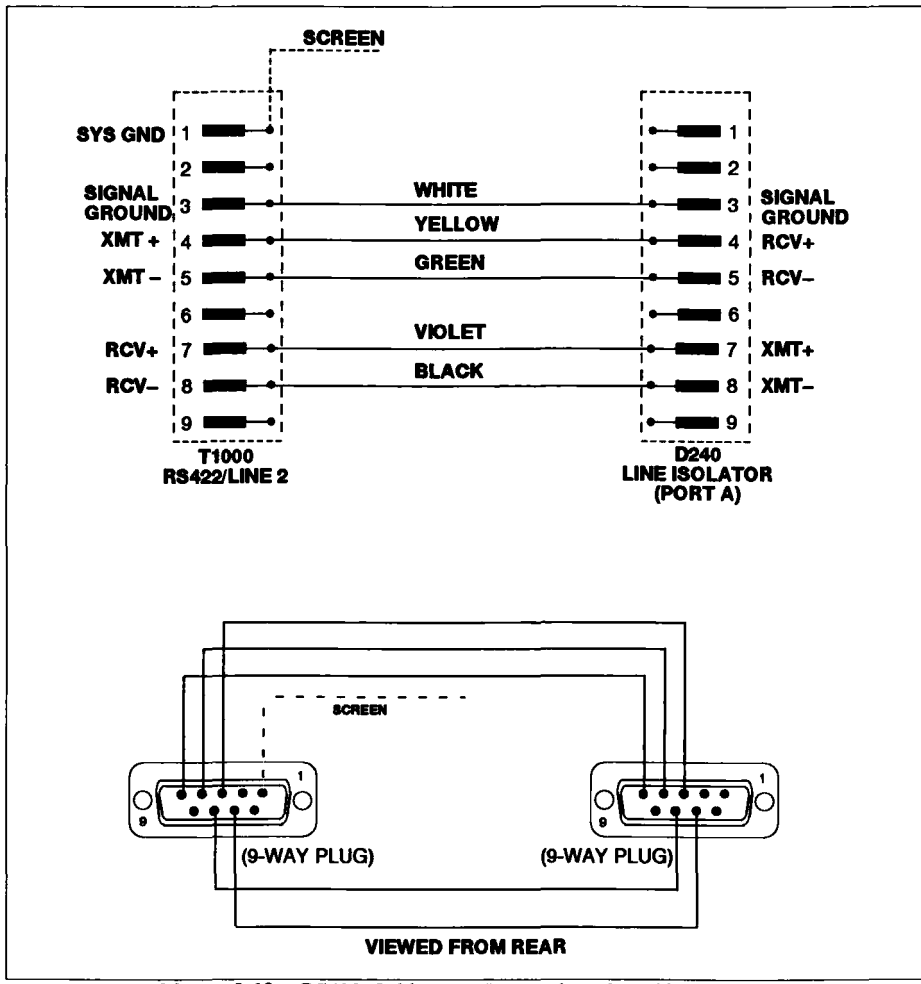


Figure 2.10 *RS422 Cable Pin Connections for T1000 to D240*

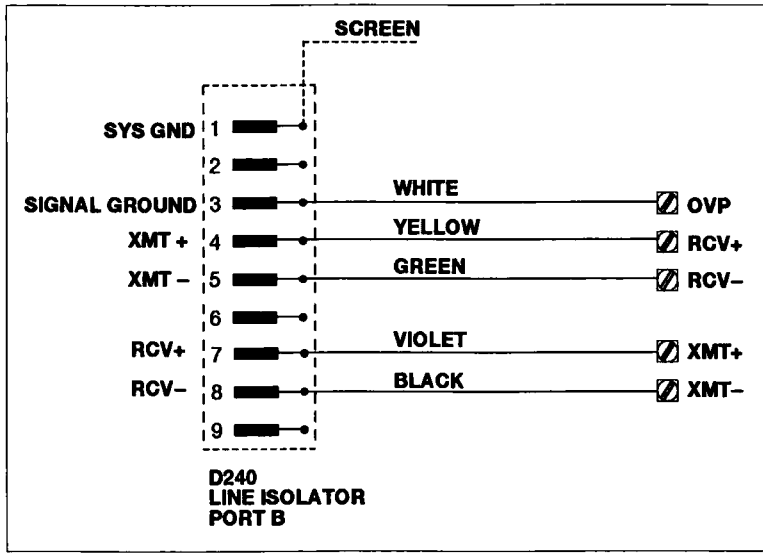


Figure 2.11 *D240 Port B Connections to System 6000 Bin*

Chapter 3

CONTROL CONFIGURATION: OVERVIEW

Chapter 1, *Introduction*, and Chapter 2, *Installation*, have already told you what the T1000 is, what it does, and how to get it running. The aim of this and the next three chapters is to introduce you to the broad range of facilities offered by T1000. You are shown in outline the various stages of control strategy and graphics configuration, documenting, file handling, and runtime operation, and the instrument's most useful features are highlighted.

This overview is not meant to be comprehensive and does not present the detailed instructions, parameter configuration information, and so on that you will need to fully implement and run a strategy. For that you must consult the 'reference' parts of this manual (Chapters 7 to 11), together with the other publications introduced in Chapter 1.

Configuring a Strategy: The Main Stages

To configure and implement a strategy in the T1000 you generally go through the following broad stages:

- **Control Configuration** — i.e. configure the *Control* part of the strategy, using the on-screen block-structured approach built into the T1000. This control configuration is the subject of the present chapter.
- **Sequence Configuration** — i.e. configure the *Sequence* part of the strategy using T1000's sequence configurator. This is described in the *T1000/T100 Sequence Reference Manual & User Guide*, included in this product manual binder (SEQU option only).
- **Graphic Configuration** — i.e. design the static and dynamic *Operator Graphics* (mimics) you want appearing on the T1000 screen during runtime. This is outlined in Chapter 4, *Graphic Configuration: Overview.*
- **Documentation** — i.e. document the control strategy and graphics using the hardcopy facilities provided by the T1000.

Control Configuration: The Basic Steps

For this first stage, control configuration, T1000 adopts a block-structuring approach. Box-shaped symbols called *function block icons* representing each input and output signal operation, and interconnection 'wiring' line-symbols, are manipulated on the screen's 'worksheet' with the front-panel wipe pad (or an optional *mouse* or *trackerball*). An example of part of a block-structured control strategy is shown in Figure 3.1.

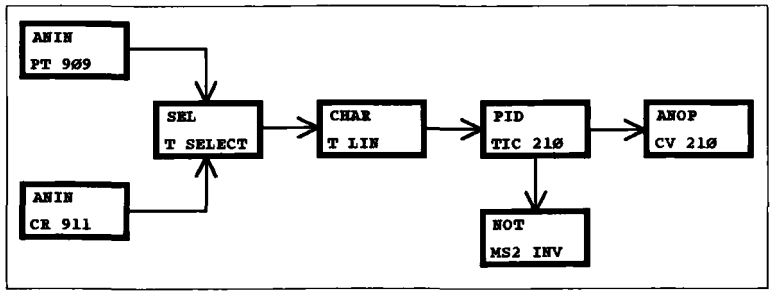


Figure 3.1 *Example Block-Structured Control Strategy*

To use this method with the T1000 you carry out the following three basic steps:

1. **Place the Blocks** — i.e. select the function block icons you need from the *function block library* and position them on the screen in the control worksheet area.

2. **Wire them Up** — i.e. draw the connection 'wiring' between the blocks on the screen to define the signal flow through the control strategy.

3. **Parameterise** each function block by entering values into its Specification Menu (parameter 'template').

You don't have to keep to the above order. Blocks, wiring, and parameter values can be added, modified, or deleted at any time using the set of configuration tools provided by the T1000.

The Power-Up Screen

When you switch on the T1000 you generally see the *power-up screen*, shown in Figure 3.2 with its three softkeys — RUN, CFIG, and UTIL — along the bottom. In the display-only version (DISP option) only two softkeys appear — RUN and UTIL.

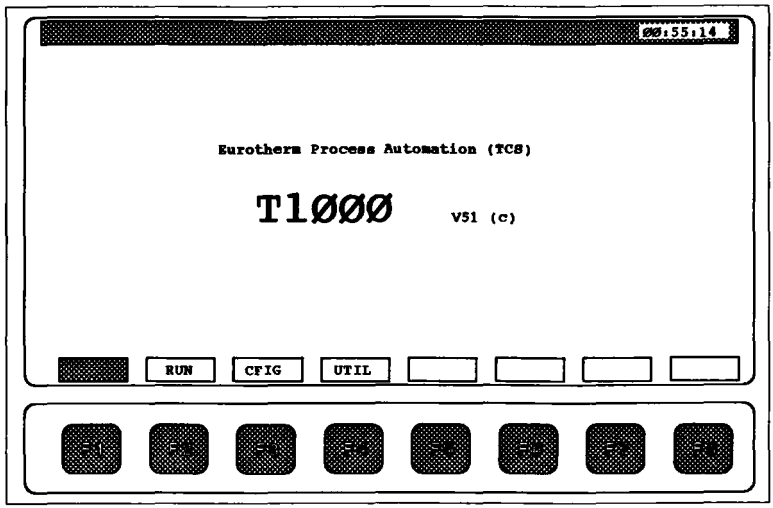


Figure 3.2 *TACTICIAN T1000 Power-Up Screen*

NOTE. If a *startup file* has been configured, via the SETUP utility, this starts running automatically on power-up.

Optional Input Devices. Two optional input devices are available for connecting to the T1000 to speed up data entry: an optical 'mouse', and an external keyboard with integral 'trackerball'. Either of these devices can be used instead of, or in addition to, the front-panel wipe pad and on-screen keyboards, but cannot both be connected to a T1000 at the same time.

Using Softkeys. To access one of the softkey functions displayed along the bottom of the screen you press the corresponding field keypad beneath it. These are labelled F1 to F8 and line up with the softkey legends on the screen. (You can, alternatively, usually select softkeys via the mouse or trackerball input devices, if connected.)

NOTE. RUN displays the control strategy files available for running. CFIG accesses the strategy configuration tools, which are outlined next. UTIL accesses various utilities including file-handling, networking, the system clock, and others. The current time in hours: minutes: seconds is displayed at the top right corner of the screen.

CardWatch™ Softkey Security. To prevent unauthorised access to any of T1000's databases, a highly discriminating user-configurable security utility — *CardWatch* — continuously regulates which softkeys different levels of personnel are permitted to use. If you press a softkey without the necessary authority (as defined on your inserted DTU card), CardWatch flashes an *'Access Denied'* message and the key is inhibited. Chapter 6, *Utilities: Overview*, gives more information on CardWatch.

Pop-Up Menus. To access the configuration options, press the F3 softkey pad beneath the CFIG (Configuration) legend at the foot of the screen. A 'pop-up menu' appears at the top left of the screen listing the configuration options — CONTROL, and MIMIC (see margin illustration). Note that if you have the 'S' (Sequence) option T1000, a third item — SEQUENCE — is listed (for sequence configuration).

Notice that the first menu item (CONTROL) has a cursor arrow pointing to it, and is also highlighted by being in reverse video. You can move the cursor down or up the menu list by rubbing your finger-tip in the corresponding direction over the *wipe pad* (at the lower-right of the front panel).

The Control Configuration Worksheet

To access the Control Configuration Worksheet, select CONTROL by highlighting it with the cursor and pressing the ENTER key (beneath the numeric keypad). This is how you generally select an item in one of the T1000 pop-up menus. The display changes to the *Control Configuration Worksheet*, with a new set of softkeys at the foot of the screen — the Control Configuration tools. See Figure 3.3

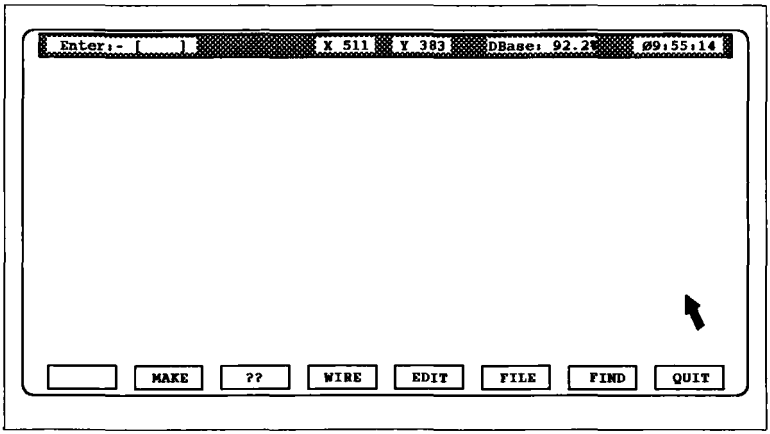


Figure 3.3 *TACTICIAN T1000 Control Configuration Worksheet*

At the top of the worksheet is a *message bar* containing an 'Enter' field, the cursor position's X-Y co-ordinates, the percentage of free memory left, and the time. The Enter field shows the last selected operation. X and Y are in pixels,

relative to the top left corner of the worksheet. The actual size of the worksheet is much larger than T1000's screen, and you can only see about 1/7th of the total area at any time. To 'window around' the worksheet you simply move the cursor off the edge of the screen, which then *auto-scrolls*.

The Control Configuration Toolkit

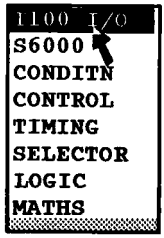
To configure your control strategy you use a set of seven 'tools', accessed via the softkeys along the bottom of the T1000 control configuration worksheet. Table 3.1 summarises what these tools do; detailed information can be found in the relevant chapters later in this manual.

This section outlines the purpose of each tool as the three basic configuration steps are explained.

Tool	Purpose
MAKE	Selects function blocks from the resident library and places them on the screen
?? (QUERY)	Displays and updates data on function blocks, wires, or compounds
WIRE	Interconnects function blocks
EDIT	Moves, resizes, copies, deletes, and compounds objects
FILE	Loads, saves, prints, and 'fixes' strategy files
FIND	Pin-points a function block on-screen
QUIT	Returns to the power-up display. De-zooms a compound

Table 3.1 *The T1000 Control Configuration Toolkit*

Placing Function Blocks



Pressing the MAKE softkey accesses a resident 'library' of function blocks, from which you select the required ones and position them on the worksheet. Note that a T100, T1000, or T231 'header' block must be placed in the worksheet initially before the rest of the strategy is configured, to represent the instrument in the control system. (The purpose of these blocks is explained fully in the *LIN Blocks Reference Manual.*)

The Function Block Library. T1000 provides you with a comprehensive library of function blocks, grouped into thirteen categories. The block names and categories are shown in Table 3.2. (For full details of their functions and parameters please refer to the *LIN Blocks Reference Manual.*)

Category	Block(s)	Function
T100 I/O	ANIN	Analogue Input channels (via T100s)
	ANOP	Analogue Output channels (via T100s)
	DGIN_8	Digital Input channels (8-way, via T100s)
	DGOUT_8	Digital Output channels (8-way, via T100s)
	TCOUPLE	Temperature reading Analogue Inputs (via T100s)
	RTD	Temperature reading Analogue Inputs (via T100s)
	FULL_TC8	Thermocouple Input (via T112)
	FREQIN	Frequency Input (via T130)
S6000	S6360	Controller Templates for System 6000 comms.
	S6366	Controller Templates for System 6000 comms.
	6432 AI	Analogue Input Templates for System 6000 comms.
	6432 AO	Analogue Output Templates for System 6000 comms.
	6432 DI	Digital Input Templates for System 6000 comms.
	6432 DO	Digital Output Templates for System 6000 comms.
	GEN_COMM	Generic 6000 Communications block
CONDITN	INVERT	Inverts signal about HR, LR limits
	RANGE	Re-ranges an analogue input
	CHAR	16-point Analogue Characteriser
	UCHAR	16-point Characteriser for T100 Analogue Input blocks
	FILTER	First-order filter
	LEADLAG	Lead-Lag block
	LEAD_LAG	Lead-Lag block
	AN_ALARM	Alarm block, with Absolute/Deviation/Rate Alarms
	DIGALARM	Digital Alarm block
	FLOWCOMP	Computes flowrate, corrected for pressure, temperature, & density
CONTROL	PID	PID control function
	ANMS	Analogue Manual Stations
	DGMS	Digital Manual Stations
	SIM	Simulation block, 2 x first order or capacity, and noise
	AN_CONN	Analogue Connections blocks
	DG_CONN	Digital Connections blocks
TIMING	SEQ	Multi-segment slope/level/time block, 15 O/P digitals
	SEQE	SEQ Extender block
	TOTAL	Totaliser (integrator) block for analogue variable
	DTIME	Delay block for deadtime applications
	DELAY	Delay block for deadtime applications
	TIMER	Timer block
	TIMEDATE	Clock and Calendar Event block
	TPO	Time-Proportioning Output block
	RATE_ALM	Up- & down-rate alarm applied to PV, with OP held at last non-alarm value
	RATE_LMT	Rate-limiter & ramp generator
SELECTOR	SELECT	Outputs Highest, Middle, Lowest, or Median of 2, 3, or 4 inputs
	SWITCH	Single-pole double-throw switch for analogue signals
	ALC	Alarm Collection block producing a common logic O/P
	PAGE	Selects up to 8 display pages through Page Pending feature
	2OF3VOTE	Selects 'best' input from three, by averaging only the within-tolerance inputs

continued . . .

continued...

Category	Block(s)	Function
LOGIC	PULSE	Pulse output, (Monostable) Function
	AND4, OR4, XOR4	Logical (Boolean) operators
	NOT	Logical (Boolean) operators
	LATCH	D Type Flip-Flop function
	COUNT	UP/DOWN pulse counter with START/END Count Target
	COMPARE	Indicates Greater/Less Than/Equal of 2 inputs
MATHS	ADD2	Add 2 signals
	SUB2	Subtract 2 signals
	MUL2	Multiply 2 signals
	DIV2	Divide 2 signals
	EXPR	Free Format Maths Expression with up to 4 inputs
	ACTION	Action control, with use of stored variables and elapsed time
CONFIG	T100	Cached System block accessing realtime clock and System alarms
	T1000	Cached System block accessing realtime clock and System alarms
	T231	Cached System block accessing realtime clock and System alarms
HIST	HIST*	Collects and files data for Longterm Historic Trends
DIAG	DB_DIAG	Database Resource Information
	LRA	Controls LIN Redundancy Algorithm operating modes
	SUM_DIAG	Summarises data on network and database faults within a running instrument
	LIN_DIAG	Local Instrument Network (LIN) Diagnostics
	LIN_DEXT	LIN High Level Performance Statistics
	EDB_DIAG	External Remote Database Information
	EDB_TBL	External database diagnostics
	UCTUNE	T1000 Performance Statistics
	MDTUNE	T100 Performance Statistics
	T231TUNE	Performance statistics
	ROUTETBL	Routing table
	RTB_DIAG	Routing table diagnostics
	NODE_MAP	LIN node protocol
	XEC_DIAG	Task diagnostics
	DTU_DIAG	Data Transfer Unit (DTU) diagnostics
	TOD_DIAG	Controls and monitors network time-of-day synchronisation
	S6_DIAG	S6000 binary synchronous comms driver setup/diagnostics
BATCH	SFC_CON	Sequence (SFC) control, selection, and running
	SFC_MON	Sequence (SFC) runtime monitoring
	SFC_DISP	Display/monitoring/control of remotely running Sequence (SFC)
	RECORD	Storage/retrieval of analogue/digital values for runtime use
	DISCREP	Transmitted/received digital signal-matching to diagnose plant faults

Table 3.2 *Function Block Categories*

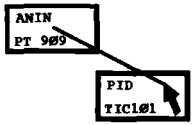
Editing the Control Configuration Worksheet. While placing function blocks on the screen to build up your control strategy, you will very soon want to edit them in some way. The EDIT softkey options — see margin illustration — allow objects to be moved, resized, copied, and deleted.

- **MOVE** relocates objects, singly or within a defined worksheet area.
- **SIZE** allows the size and shape of some of the function blocks (e.g. compounds) to be altered.
- **COPY** lets you replicate a single block, or all blocks in an area. Parameter values are replicated along with the block, except for the block name, which defaults to "NoName". Wiring is not replicated.
- **CMPD** (Compound) lets you combine any number of blocks in a selected area of the worksheet into a single tagnamed 'compound block'. This does not affect the action of the control strategy in any way, but it can save a lot of worksheet space and makes it far easier to understand the layout of complex hierarchical block structures. Blocks and any wiring inside the compound are concealed, but wiring between the compound and other blocks remains visible. Using the **??** (Query) softkey you can 'zoom' the compound to see the blocks inside it, and give the compound a tagname and a new type name instead of the default CMPND.
- **DEL** (Delete) allows function blocks and connections, singly or within a defined area, to be deleted.
- **CLS** (Clear Screen) lets you clear *all* function blocks and connections from the entire worksheet — and the strategy database — in one action.

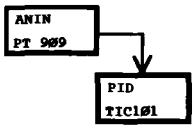
Locating a Particular Function Block. For a complex control strategy with many function blocks spread over the whole worksheet, it is very useful to be able to bring a particular block quickly into view without having to scroll around looking for it. The FIND tool does just this.

Filing Operations. When you are ready to quit the session and want to save your layout to one of T1000's memory areas, you use the FILE softkey. The four FILE options — LOAD, SAVE, PRNT, and FIX — can be used at any time to load, save, print out, and 'fix' control strategies. (FIX amends a block and wiring graphics file to match its corresponding database file, when these have been mismatched.) Note that before letting you save a strategy, T1000 checks that all blocks have been given *tagnames*. (Blocks are named during the Parameterisation step, outlined below.)

Wiring Up the Blocks



After positioning some function blocks on the worksheet you are ready to draw connection 'wiring' between them, defining the signal flow through the control strategy. For this you use the WIRE softkey. The margin illustrations show (*upper*) two blocks in the process of being 'wired' together and (*lower*) the completed connection.



Making connections to or from a *compound* block is similar to wiring up regular blocks, but includes the extra step of selecting the particular block within the compound that you want to connect to. 'Zooming', via the **??** softkey, shows exactly where the wiring goes within the compound.

Querying Wiring & Blocks. During control configuration, the QUERY (**??**) softkey lets you see information about a function block, compound, or wire. Specifically, querying a wire symbol shows a source/destination list of all the connections in the selected wire or 'bus'. Figure 3.4 shows an example *connections menu* for a 6-wire bus from a SEQ block to a PID block. (Querying blocks is outlined in the section *Parameterising Blocks*, below.)

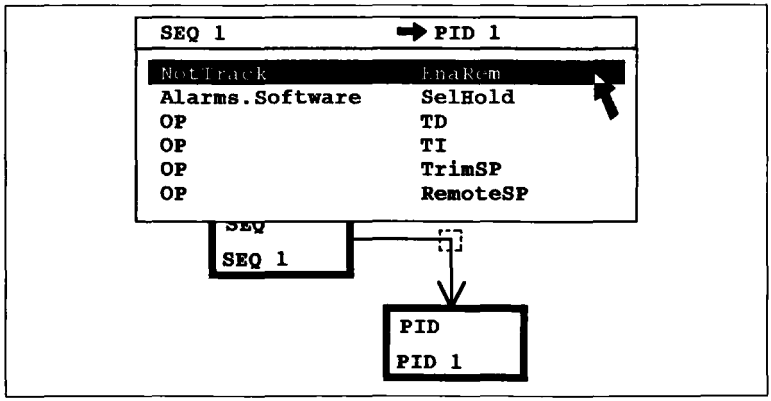


Figure 3.4 *Example Pop-Up Connections Menu*

Loopbreak. Sometimes a small dotted circle appears round a wiring arrowhead. This is due to the action of a special facility — *Loopbreak* — which can be accessed via a wire's connection menu. The significance of this is described in Chapter 9 in the *WIRE softkey* section, under the heading *Closed Loops — Loopbreak*.

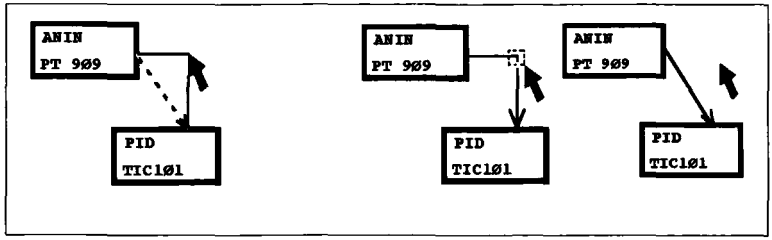


Figure 3.5 *Editing Wiring*

Editing Wiring. You can use two of the EDIT softkey functions to modify wiring. MOVE *adds* extra corners to the wire, and *moves* existing corners and wire-ends. DEL *deletes* wires and corners. Figure 3.5 shows how some of these operations appear on T1000's screen; full details are given in Chapter 9.

Parameterising the Function Blocks

Specification Menu

Having placed the *types* of block you want in the control worksheet and wired them together, you need to provide information that characterises each block uniquely. You do this by filling in a **Specification Menu** for every block on the worksheet. In the Specification Menu, accessed via the QUERY softkey, you enter block parameter values; i.e. *parameterise* the block. The values are stored in the control database for use during runtime. After parameterising a function block, you can query it again to recall its Specification Menu for review or update. Figure 3.7 shows a typical menu.

Querying a *compound* block displays its 'compound menu' (Figure 3.6) rather than a Specification Menu. This menu lets you 'zoom' the compound to reveal the blocks inside, which can then be queried individually.

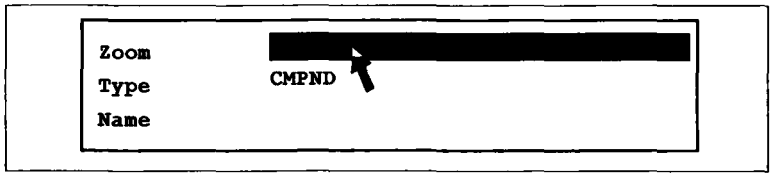


Figure 3.6 *The Compound Menu*

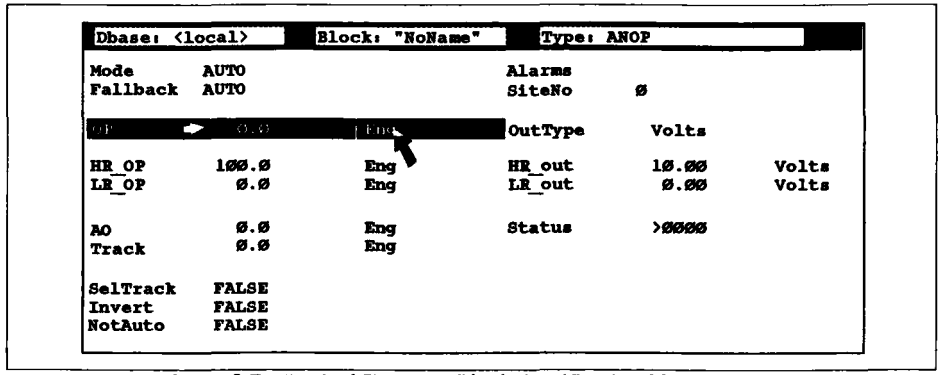


Figure 3.7 *Typical Function Block Specification Menu (ANOP)*

Title Bar. Common to all Specification Menus is a shaded 'title bar' along the top which contains three fields: **Dbase**, **Block**, and **Type**.

- The **Dbase** field specifies the eventual physical location of the block when the system is fully installed. Although you configure the block in a particular instrument, you can use the Dbase field to relocate the block's database and associated runtime software in any other suitable instrument in the final networked system.
- The **Block** field contains the user *tagname* you give the block to identify it and distinguish it from other blocks of the same type.
- The **Type** field is read-only and is simply the function block type, e.g. ANIN, PID, SIM, etc.

NOTE You can select an area of blocks with the ?? (Query) key and assign them to a selected database, or rename them all, in a single operation. See Chapter 9, *?? (Query) Softkey*.

Data Field Values. Initially most of the data fields have default values in them that you edit as needed. Specification Menus are 'intelligent' in their reactions to editing. For example, specifying particular units for a parameter causes the units for all related parameters in the menu to change automatically to the new specification.

Some parameter values may be marked by a small 'arrow' — Figure 3.7 shows an example — signifying that the value is being updated by an incoming connection from another block in the strategy. If you ENTER such a parameter (see next), a window appears showing the source of the connection.

Data Input. To access a field for data input, point at it with the cursor to highlight it in reverse video, then press the ENTER hardkey or equivalent in an optional input device. (Read-only parameters cannot be highlit.)

Most parameters have a read-only *name* or mnemonic, and a *value*, with *units*, which you can alter.

What you see when you access a data field depends on the type of field selected. There are four types of data field classified by the sort of data required. These are: *decimal number*, *hexadecimal number*, *alphanumeric character*, and *menu selection* fields. Sometimes a data field of one type is nested within a field of another type.

On-Screen Keyboards

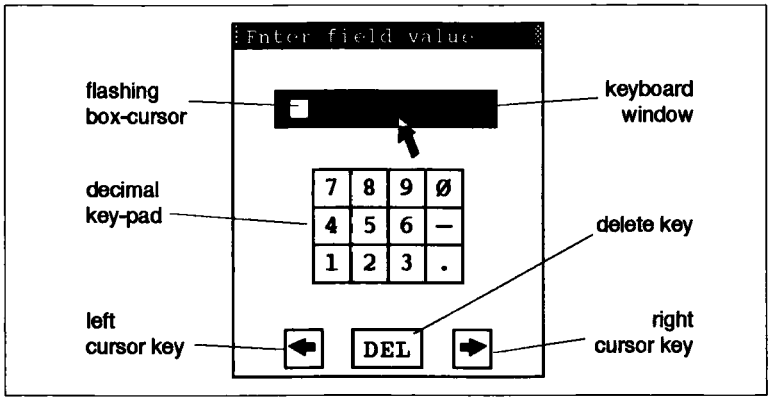


Figure 3.8 *The On-Screen Decimal Keyboard*

When you select a particular data field it responds with a display suited to the entry needed: either a customised 'keyboard' simulation or a scrollable pop-up menu. Figures 3.8 to 3.10 show some of these on-screen keyboards and also the T1000 front-panel numeric keypad — used for typing decimal numbers, and for entering/cancelling operations.

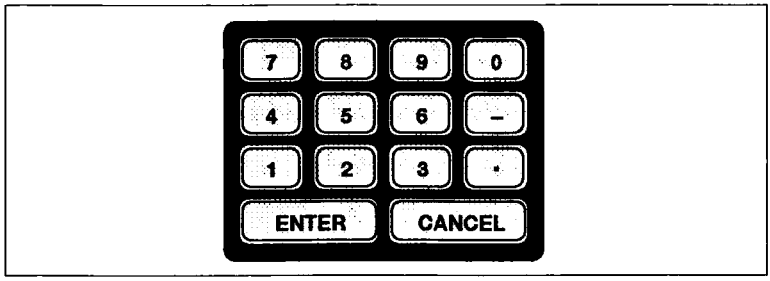


Figure 3.9 *The Front-Panel Decimal Keyboard*

You use these on-screen keyboards by pointing the cursor at the required character on the 'keypad' and pressing ENTER. Alternatively, an external trackerball keyboard may be used. T1000 automatically does decimal place rounding, limiting, and notation changes appropriate to the data field being updated.

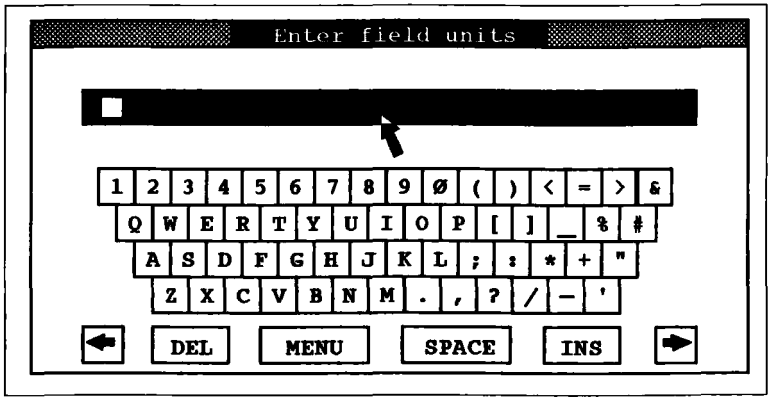


Figure 3.10 *The On-Screen 'QWERTY' Keyboard*

Selecting an *alphanumeric* field brings a full 'Qwerty' key-board to the screen (Figure 3.10).

Amongst the Qwerty keyboard's special 'keys' is **MENU**, which can save time and avoid errors when you are entering block tagnames. Hitting MENU displays a list of available and relevant tagnames, from which you choose the one required without having to key it in letter-by-letter. A particularly useful feature of MENU is that it can act as a 'wild' key, listing only tagnames starting with the character(s) currently in the keyboard window.

Menu Selection Entry

Selecting a *menu selection* field, e.g. the **Mode** parameter in the ANOP block Specification Menu (Figure 3.7), displays a pop-up menu listing the choices available. (See margin.)

Alarms Field

The Alarms field accesses a special *Alarms Priority* Menu (Figure 3.11), which indicates block alarm status and allows you to specify alarm priorities, via a customised on-screen decimal keyboard.

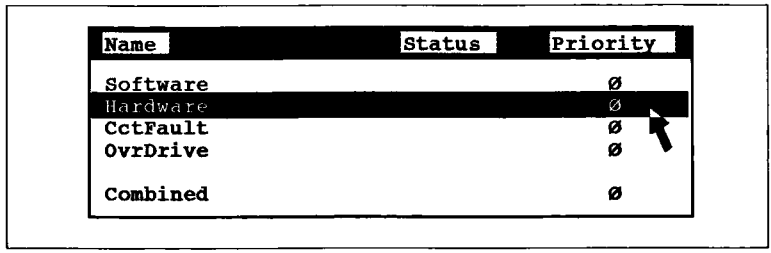


Figure 3.11 *An Alarms Priority Menu (Example)*

Quitting the Control Configuration Worksheet

You press the QUIT softkey to quit the worksheet and return to the power-up screen. T1000 always asks '*Are you sure?* ' before executing the command, allowing you to save the configuration if required. If you have not saved the strategy it will be lost when you quit the worksheet.

Chapter 4

GRAPHIC CONFIGURATION: OVERVIEW

The second main stage in the configuration and implementation of a control strategy is designing the static and dynamic operator graphics you want appearing on-screen during runtime. For this the T1000 provides you with a *graphic configuration worksheet*, and a comprehensive and powerful set of *graphic configuration tools*, accessed via soft keys in a similar way to the control configuration tools outlined in Chapter 3.

You use these tools to create 'pages' and 'windows' of dynamic runtime displays — faceplates, graphs, alarms, bargraphs, text, numeric readouts, plant mimics, etc. — which you link to the control strategy to give your operators a moving picture of the state of the controlled process.

Graphic Configuration: The Basic Steps

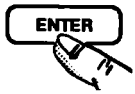
To configure graphics pages for a control strategy you carry out the following two basic steps:

1. Select graphic objects from the resident library, and position/size/customise them on the graphic configuration worksheet.

2. Make the required graphic objects *dynamic* by linking them to points in the control database.

The Graphic Configuration Worksheet

You access the graphic configuration worksheet (shown in Figure 4.1) from the T1000 power-up screen, by pressing the **CFIG** softkey and selecting **MIMIC** from the menu displayed.



NOTE. T1000's *CardWatch* utility will inhibit the CFIG softkey and flash an 'Access Denied' message if the required security level is not present — either on an inserted DTU card or in the resident security setup. Refer to Chapter 6, *Utilities: Overview*, for more information on CardWatch.

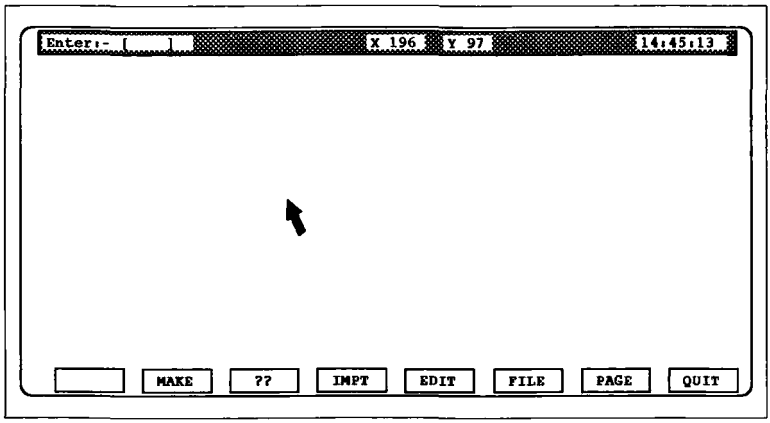


Figure 4.1 *TACTICIAN T1000 Graphic Configuration Worksheet*

When first accessed, the empty worksheet displays a list of filenames of available control strategies stored in the T1000's memory areas, from which you select the strategy that will link to the new graphics.

The graphic configuration worksheet resembles the control configuration worksheet, but is much smaller, filling exactly one T1000 screen.

Graphics Pages

Using the worksheet you can create and save up to a nominal twenty dynamic graphic displays — *pages* — linked to a given control strategy and accessible during runtime. The exact number depends on file sizes and available memory. You assign each page a number, and also an optional page name or title (via the PAGE softkey). Before quitting a configuration session, or starting on another graphics page, you must *save* the page to one of T1000's memory areas. Titling, numbering, and general filing of pages are done using the PAGE and FILE softkeys.

Windows. As well as normal pages that fill the whole screen, you can also use the WINDOW tool to create smaller 'mini-pages' called *windows*. Windows are similar to regular pages but they cover only part of the screen, letting you see the rest of the full page at the same time. They are especially useful for looking at detailed inset graphics without losing the overview whole-screen graphic. Any number of windows can be open simultaneously, overlaid on the main page. Figure 4.2 shows an example of windows.

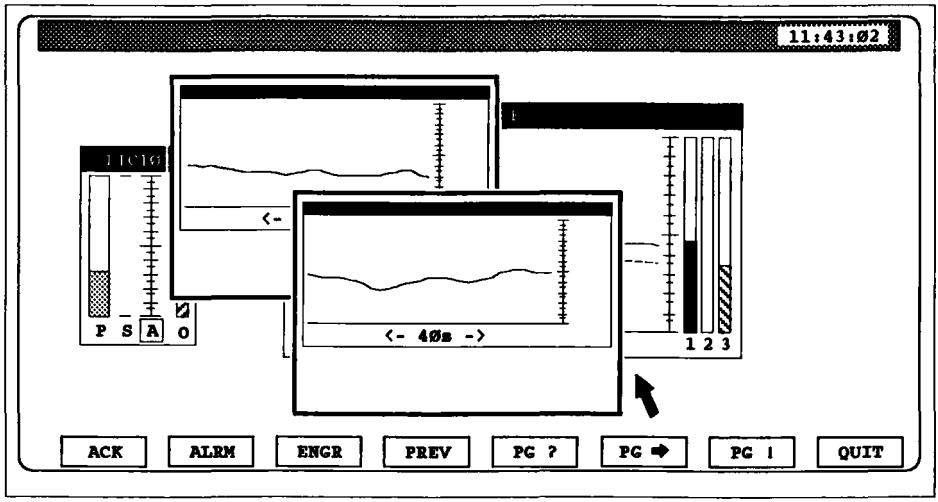


Figure 4.2 *Example of Windows at Runtime*

Runtime Page-Changing. At runtime T1000 lets the operator move from page to page, or prompts him to view a particular page, in a variety of ways depending on how the comprehensive page-change facilities have been configured. (During control strategy configuration you may have used the PAGE block to set up emergency graphics 'pending pages'. The *page-pending* facility is outlined in Chapter 5.) In graphics configuration you can prearrange page-changes via the PAGE softkey, and also the PAGECHNG and ICON tools.

Graphic Objects

Object Types. Two types of graphic object can be created in the configuration worksheet: *static* and *dynamic*. Static objects do not change their appearance during runtime, and are used to represent, for example, pipework, valves, fixed labels, etc.

Dynamic objects must be linked — via the QUERY (**??**) softkey — to points in the control strategy to make them change their appearance as the linked points vary in value. They can represent liquid levels, digital displays, instrument front panels, trend plots, alarm annunciators, and so on. Not all objects can be made dynamic, and you can leave a (potentially) dynamic object unlinked if you want to. It will then behave as a static object during runtime.

ENTERing Dynamic Objects. Apart from presenting an animated picture of what the process is doing, most dynamic graphic objects can be cursor-selected at runtime by an operator and 'ENTERed' by pressing ENTER — provided they have been entry-enabled for that operator. The linked point's value can then be varied from the T1000 screen. You can configure a graphic object to be ENTERable by any of up to four 'Users' — A, B, C, and D — identified by their DTU cards via the CardWatch utility. Or you can leave the object at its default non-ENTERable state.

The Graphic Configuration Softkeys

The softkeys along the bottom of the worksheet access groups of drawing and configuration tools, summarised in Table 4.1 and outlined in the following sections. Full details are given in the relevant chapters later in this manual. Pressing a softkey usually pops up a menu of options from which you select the required one.

Creating Graphic Objects — The MAKE Softkey

The MAKE softkey options access T1000's five groups of drawing and writing tools — DRAW, TEXT, FASCIAS, DISPLAY, and ICON — outlined in the following sections.

DRAW

Lines & Ellipses. The DRAW option includes the POLYLINE and CIRCLE tools, used for drawing free-format straight lines, polygonal figures, circles and ellipses. The EDIT tools (see later) can be used to move and replicate polylines, or modify them by adding/removing angles, and by shifting the positions of angles. Ellipses can also be resized/reshaped as required.

TEXT

Text Strings. The TEXT options let you put a variety of textual and numeric fields in your runtime graphic display, most of which can be made dynamic.

- **TEXT.** The TEXT tool allows simple non-interactive alphanumeric fields of any size and shape to be placed on the screen. These can act as static labels or titles. The ?? (QUERY) softkey lets you key in the characters you

want appearing in the newly defined TEXT field, or alter an already-configured field. QUERY is also used to configure the other TEXT menu fields, and indeed all the other configurable graphic objects you create.

Softkey	Option	Tool	Purpose
MAKE	DRAW	POLYLINE	Free format lines and polygonal figures
		CIRCLE	Circles and ellipses
	TEXT	TEXT	Text strings
		READOUT	Readout/operator entry of dynamic variables
		CONDTEXT	HI/LO digital switched text with display options
		MESSAGE	8-level prioritised message field
		MENUITEM	Readout field with 8-item pop-up assignment menu
		STEP.X	Two-state message field linked to activity of a sequence step
		STEP.T	Readout field of sequence step elapsed activity time
	FASCIAS	CONTROL	Standard controller fascia
		ANMAN_ST	Auto-manual loading station fascia
		DGMAN_ST	Digital loading station fascia
		TREND	Graphical trends display window
	DISPLAY	BAR	Vertical/horizontal bargraphs with choice of shading
		DIG_ITEM	Single digital item with tag and HI/LO messages
		DIGGROUP	Compound block of 8 digital items
		PAGECHNG	Page-change icon linked to digital Flashes when HI
		WINDOW	Window or 'mini-page', overlaid on whole-screen display
	ICON	ICON	Symbol builder and editor. Symbols can be page-change icons
		CONDICON	Two-state digital ICON
??(QUERY)	—	—	Displays and updates data on any graphic object on the screen
IMPT	—	—	Imports graphics from other strategies
EDIT	MOVE	—	Moves graphic objects
	SIZE	—	Resizes graphic objects
	COPY	—	Replicates graphic objects
	CMPD	—	Groups graphic objects into compounds
	DEL	—	Erases graphic objects
	CLS	—	Clears entire worksheet or active window and contents
FILE	LOAD	—	Loads specified graphics page from memory to the worksheet
	SAVE	—	Saves active graphics page to memory
	PRNT	—	Screen dumps worksheet to printer
PAGE	—	—	Names active page and specifies a follow-on page
QUIT	—	—	Returns to the power-up display

Table 4.1 *The Graphic Configuration Softkeys*

- **READOUT.** Places on the screen a field to display numeric or textual variables, updated dynamically from the control strategy in runtime. To make it dynamic you link it to a point in the control strategy via QUERY. At runtime READOUT is ENTERable allowing operator interaction.

- **CONDTEXT.** Creates a runtime ENTERable field to display either of two alternative text messages, selected by a digital signal in the control strategy. The conditional text may also be set to flash on and off, in either or both conditions.

- **MESSAGE.** Creates a dynamic read-only field with up to eight messages which can each be selected with digital inputs. Only the highest priority active message is displayed at any time.

- **MENUITEM.** Creates a dynamic textual or numeric readout field, enterable at runtime to display a pop-up options menu of pre-configured values. You select the chosen value and assign it to the linked database point.

- **STEP.X** & **STEP.T** are available only in the T1000 'S' (Sequence) option. STEP.X creates a dynamic read-only field that displays one of two text messages, depending on the activity of a *step* in a Sequential Function Chart (SFC). STEP.T creates a dynamic readout field displaying the elapsed *activity time* of a step in an SFC.

CONTROL
ANMAN_ST
DGMAN_ST
TREND

FASCIAS

Faceplate Symbols & Trend Windows. The FASCIA tools include interactive faceplate symbols that link to corresponding function blocks in the control strategy, letting you to read and update them during runtime, and also a graphical trends display window for plotting up to three selected variables.

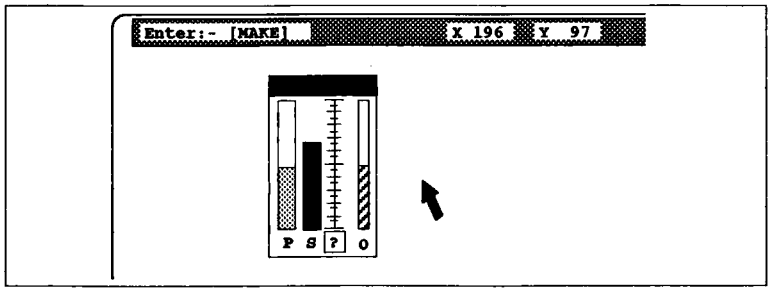


Figure 4.3 *CONTROL Faceplate Symbol*

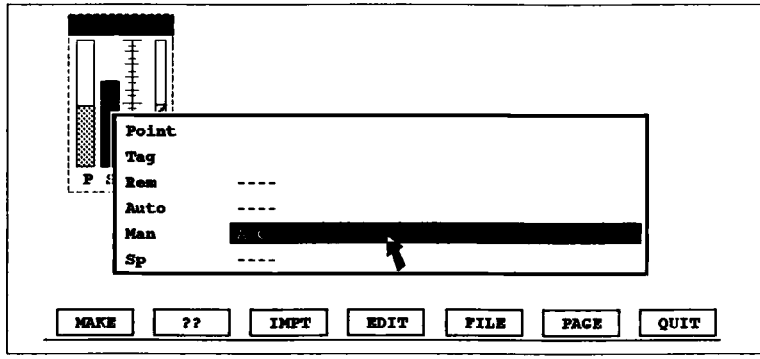


Figure 4.4 *CONTROL Faceplate Pop-Up Menu*

- **CONTROL** lets you create standard controller faceplate symbols, (see Figure 4.3), linkable to PID control or S6360/6366 blocks. The faceplate has vertical percentage bargraphs indicating the Process Variable (P), Setpoint (S), and Output (O) of the linked control block. Control Mode is shown by the letter in the small box below the % graduations. Alarm levels are also marked on the bargraphs.

  Configuring the faceplates via the QUERY softkey accesses the pop-up menu shown in Figure 4.4.

  At runtime a faceplate symbol can be ENTERed to access and 'press' enabled front-panel 'pushbuttons' simulating the R (Remote), A (Auto), M (Manual), SP (Setpoint), and Raise/Lower buttons on a real controller instrument. In this way, the mode or setpoint of the linked controller can be altered. In Figure 4.4, only the faceplate's 'Manual' button has been entry-enabled — for Users A and C exclusively.

- **ANMAN_ST** lets you create an Analogue Manual Station block faceplate symbol, illustrated in Figure 4.5.

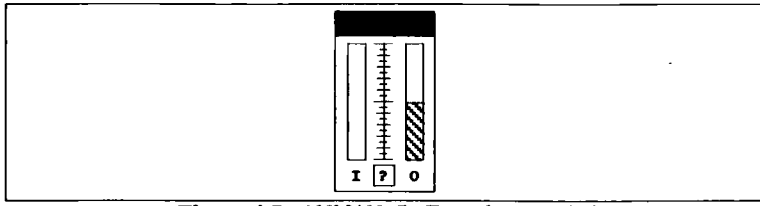


Figure 4.5 *ANMAN_ST Faceplate Symbol*

The faceplate has vertical percentage bargraphs indicating the Input (I), and Output (O) of the linked ANMS block, and control Mode is shown by the letter in the small box below the % graduations.

Entry-enabled operators — with appropriate security clearance — will be able to select the faceplate and use softkey 'pushbuttons' to vary the mode (between AUTO and MANUAL) and the output.

- **DGMAN_ST** lets you place a Digital Manual Station block faceplate symbol, shown in Figure 4.6. This simple runtime ENTERable faceplate displays the states of the linked DGMS block's Input (I) and Output (O) with messages that you can configure via QUERY. It also shows the Mode of the block.

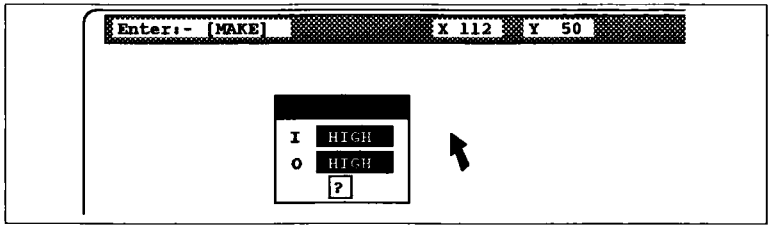


Figure 4.6 *DGMAN_ST Faceplate Symbol*

- **TREND** lets you create a small window in which you can trend up to three preselected variables during runtime. An example of a completed 'mini-trend' window is shown in Figure 4.7. The three analogue plots also appear at the right of the window as vertical bargraphs with matching bar textures and pen-numbers. Vertical scaling is automatic, based on the variable with the biggest span.

  As well as analogue variables you can also mini-trend digitals. For digitals, each pen occupies its own band in the trend, matched by a short bar

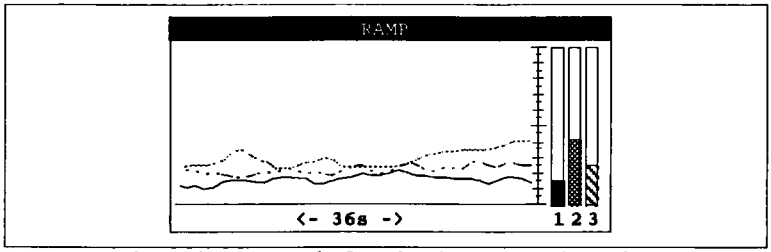


Figure 4.7 *Example Completed 'Mini-Trend' Window*

instead of the full-height analogue bargraph. When the digital is 'high', the matching bar fills and the plot steps upwards. An empty bar and low plot denote the 'low' digital state. Figure 4.8 shows a mini-trend window with digitals (pens 1 and 2) and an analogue (pen 3) being trended.

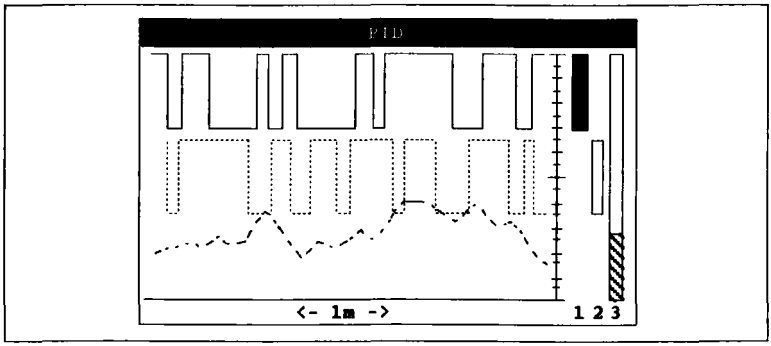


Figure 4.8 *TREND Window with Digitals (Example)*

NOTE. For a more powerful and comprehensive runtime-configurable trend facility you should use the Longterm Historic/Realtime Trend package, which is outlined in Chapter 5, *Runtime: Overview.*

The QUERY softkey accesses the TREND pop-up configuration menu (Figure 4.9) where you link the database points to the three pens, and pre-configure timespans.

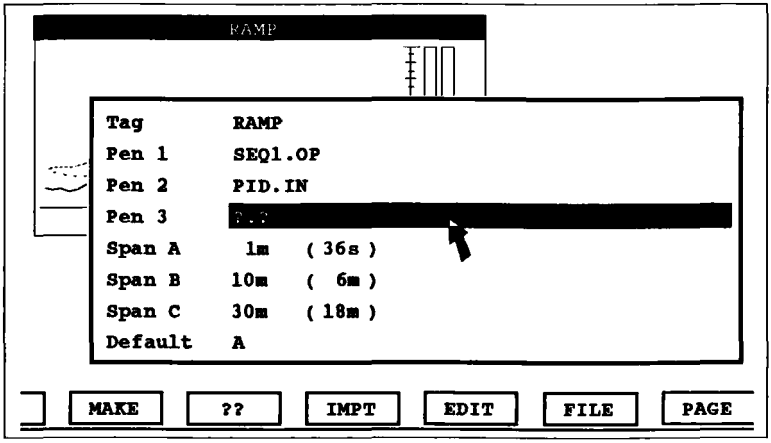


Figure 4.9 *TREND Pop-Up Menu*

DISPLAY

Interactive Analogue & Digital Displays. The DISPLAY option's first three tools let you create interactive analogue and digital displays. PAGECHNG is an icon that can be made to flash when a linked digital goes high, and also acts as a '*GOTO specified graphics page*' at runtime — useful in emergencies. WINDOW creates 'mini-pages' that overlay the main page without obscuring all of it.

- **BAR** is a powerful tool used to place a box on the screen that, when linked to an analogue point in the control strategy, acts as a vertical or horizontal bargraph. You can also link BARs to digitals, or leave them as unlinked graphic elements. Note that the BAR tool is also very useful for drawing filled *static* rectangular shapes that can build up into more complex forms representing pipework, plant etc. in a mimic. Figure 4.10 shows the BAR pop-up configuration menu.

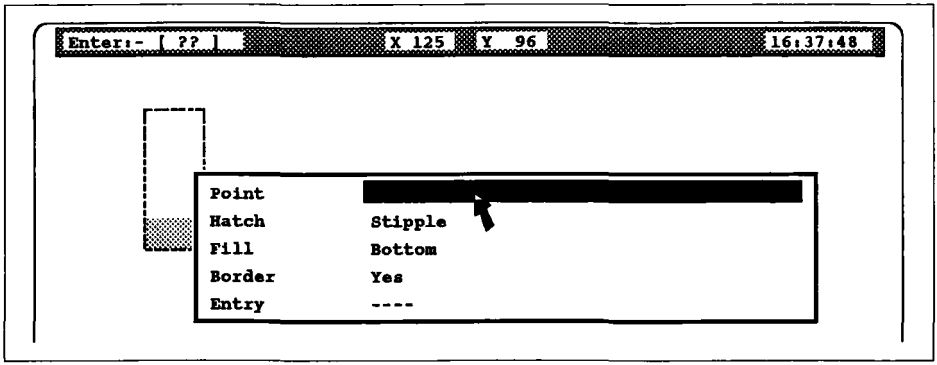


Figure 4.10 *BAR Pop-Up Menu*

You can choose one of six shades for the BAR, and also how its length/shape will respond to point value changes — up, down, left, right, deviation, digital, and full/empty (for a static bar). BARs can be made runtime ENTERable by selected operators, allowing them to alter the value of the linked point.

- **DIG_ITEM** places a fixed-size text field on the screen that reports the state of a digital point within the strategy. It does so by displaying a user-defined *high* or *low* four-character legend; the *high* legend appears in reverse video to make it stand out. At runtime, if you have enabled entry, the selected operators can access the graphic and switch the point value by pressing *high* or *low* softkeys. Figure 4.11 shows an example DIG_ITEM graphic at runtime with its special softkeys.

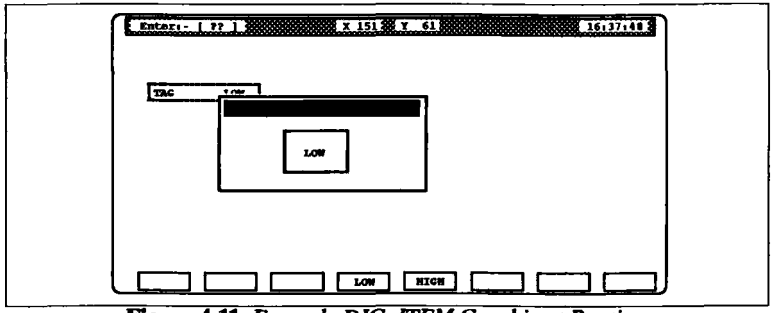


Figure 4.11 *Example DIG_ITEM Graphic at Runtime*

- **DIGGROUP** places a group of eight DIG_ITEMs together in a single graphic compound on the screen. However, each item in the group behaves as a single DIG_ITEM. You would use DIGGROUPs when you have to place large numbers or groups of related digital items.

- **PAGECHNG** places a labelled icon on the work-sheet that can be linked to a digital point in the strategy. During runtime the icon and its legend are normally steady, but they flash to attract attention if the digital goes high. When the operator ENTERs the icon (whether flashing or not) a preselected graphics page or window appears, which you can configure with relevant information. Figure 4.12 shows a PAGECHNG graphic and its pop-up configuration menu.

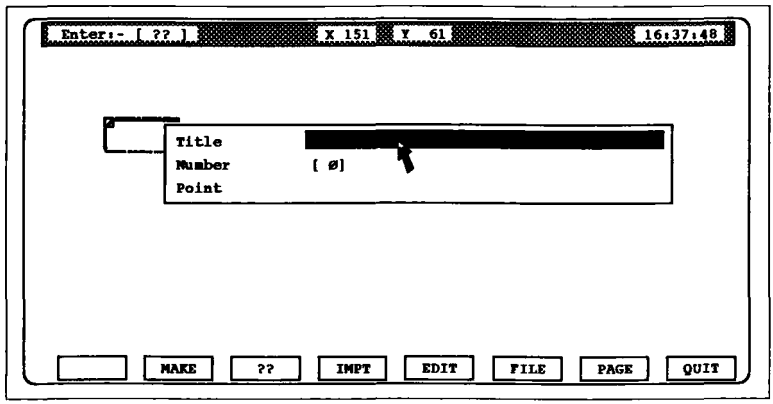


Figure 4.12 *Example PAGECHNG Graphic & Pop-Up Menu*

- **WINDOW** lets you create a variable-sized frame on the screen that behaves as a 'mini-page'. You configure graphics inside the window and name and handle it in almost the same way as any other page. But a window *overlays* the current full page when selected in runtime and need not completely obscure it. You can have any number of windows open in runtime in addition to the current full page. Figure 4.2 showed an example of windows in the runtime screen.

ICON
CONDICON

ICON

The Symbol-Building Toolkit. The ICON option includes two tools: ICON and CONDICON. These tools let you design and edit your own special graphic symbols, which can be named and filed to build up a custom symbols library. They provide you with a magnified 32 x 32 pixel *symbol-build screen* on which you draw and edit 'paint-type' designs. You can apply mirror symmetries, 90° rotations, inversions, and pixel manipulations to your designs to create the detailed effects you want. The special symbols can be used on their own, or grouped together to create complex pipework, plant mimics, tones and textures, etc.

- **ICON.** With this option you can link your static custom symbol to a specified graphics page so that during runtime, ENTERing the symbol displays the linked page (or window). The symbol-build screen is shown in Figure 4.13, as it appears (four times actual size) when the ICON configuration menu is accessed. Figure 4.14 shows some examples of ICONS.

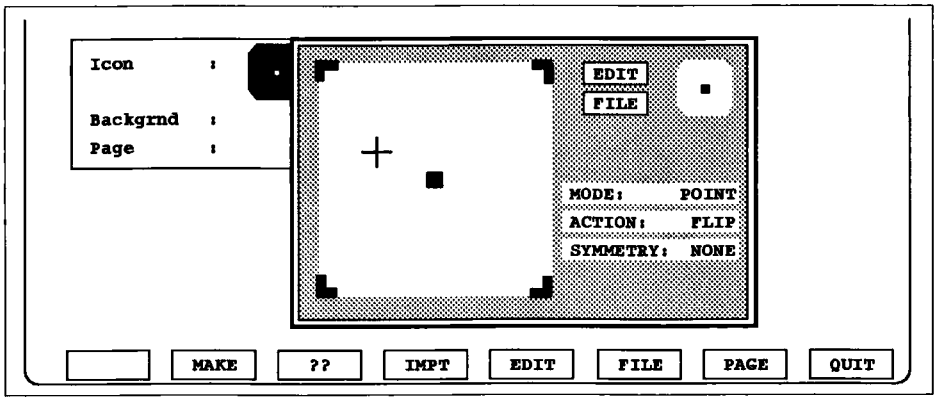


Figure 4.13 *ICON Symbol-Build Screen*

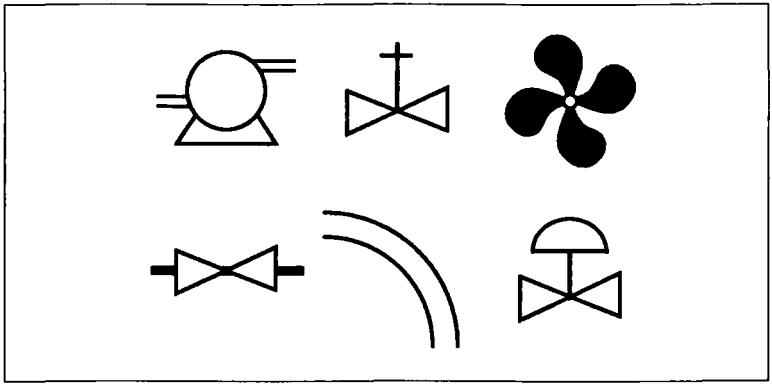


Figure 4.14 *ICON Examples*

- **CONDICON** — 'conditional icon' — lets you design a dynamic 'high/low' pair of symbols that link to a digital point in the strategy. At runtime the CONDICON switches state with the linked point, and can also be ENTERed by enabled operators letting them switch state manually. CONDICONs, placed singly or in combination, are particularly useful when you want to simulate 'animation' in a runtime graphics page.

  You can design these conditional symbols from scratch, or copy existing symbols from your ICON/CONDICON library, modifying them as required. Figure 4.15 shows the CONDICON pop-up configuration menu. Note the default 'high state' and 'low state' symbols — an up-arrow and a down-arrow. You can edit the default symbols, or load existing stored symbols to the screen for use as CONDICONs, via the symbol-build screen's FILE field. You can also store CONDICONs as individuals using the SAVE field. Once stored, ICONs and CONDICONs are completely interchangeable.

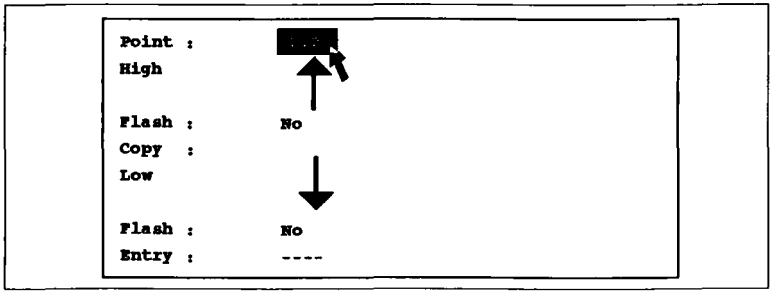
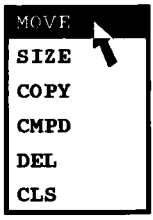


Figure 4.15 *CONDICON Pop-Up Menu*

Editing the Graphic Configuration Worksheet — The EDIT Softkey

While placing objects on the worksheet to create graphics pages, you will very soon want to alter them in some way. As in control configuration, you use the EDIT softkey for this. In the graphics worksheet, EDIT allows all objects to be *moved, copied, compounded,* and *deleted.* Certain graphic objects (and windows) can also be *resized.* Additionally, EDIT lets you *clear* the active window or page completely from the screen.



EDIT Menu

The graphic configuration EDIT menu items (see margin) are the same as those in the control configuration worksheet, outlined in Chapter 3, and most of them work in the same way.

- **MOVE.** You can move single graphic objects and those within a defined worksheet area.

- **SIZE.** Windows, and certain graphic objects, can be resized using the SIZE option.

- **COPY.** All graphic objects, or groups of objects within a defined area, can be copied using the COPY option. COPY does not work *on* a window, only *within* a window. Note that when you copy a graphic object, the copy has all the attributes of the original, including tagnames, and any links with points in the control strategy. (In control configuration, copied function blocks do not take the original tagname.)

- **CMPD** groups graphic objects in a defined area of the worksheet (or window) into a single bordered 'frame' — a graphic *compound.* The compound can be given a title, and be moved, copied, and deleted as if it were a single object. You can also use the SIZE tool on the bordering frame to change its shape, although this does not affect the objects inside the frame. These keep their individuality and can be queried and edited in the normal way. (CMPD in the control configuration worksheet behaves differently.)

- **DEL** (Delete) works in the same way as it does in control configuration. You can delete single graphic objects, or defined areas of the active worksheet or window.

- **CLS.** As in control configuration, CLS (Clear Screen) lets you clear all objects from the worksheet. But if there are windows in the graphic worksheet, CLS works differently. In this case the CLS command clears only the *active window* and its contents, that is, the last window to be loaded or created. The latest-loaded window then becomes the active one. Only after all windows have been cleared does the CLS command clear the full-screen page.

Filing Operations — The FILE Softkey

When you have finished configuring a graphics page, or if you simply want to quit the session and continue later, you must save it to memory via the FILE softkey, as for control configuration. The three FILE options (see margin) can be used at any time to recall a graphics page for editing, save it to memory, or print out the current page. Note that you have to give the graphics page a *number*, or confirm its present one, before T1000 allows it to be saved.

Using Graphics From Other Control Strategies — The IMPT Softkey

This tool lets you *import* a graphics page or window from another strategy and incorporate it into the current strategy. Once imported you can edit the page or extract what you need from it, then save it under a new page number, as required.

Quitting the Graphic Configuration Worksheet — The QUIT Softkey

You press the QUIT softkey to quit the worksheet and return to the power-up screen, in the same way as for control configuration. T1000 always asks '*Are you sure?*' before executing the command, allowing you to save the page if required.

Chapter 5

RUNTIME: OVERVIEW

Runtime Features

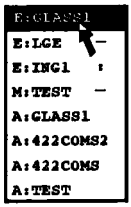
This chapter tells you about T1000's comprehensive *runtime* facilities. You should refer to Chapter 8 of this manual for full details of the runtime user interface.

Runtime Display of Graphics Pages. With clear and well-designed graphics pages and windows linked to your control strategy, operators will be kept up-to-date on the precise state of the plant. They can choose one of the (up to twenty) pages of custom dynamic graphics for display, via the page directory (PG?) softkey, and review a page with the previous page (PREV) softkey. Alternatively they can bring relevant pages and windows to the screen using the various page-directing facilities that have been configured into the strategy: next page (PG→), page change, and custom icons. In emergencies the strategy itself can automatically direct them to appropriate pages, in priority order, via the page-pending (PG!) facility. And via the same facility a 'time-out' page automatically appears when five minutes have passed since the operator last interacted with the T1000.

Interacting with the Strategy. Operators with the necessary security clearance can select enabled on-screen graphic objects with the cursor and alter control variables such as setpoints, modes, and outputs. (Security status is recorded on an operator's DTU cardkey, inserted in T1000's front panel.) At a higher security level, engineering functions, tuning variables, and so on, can also be modified via the block specification menus.

Standard Displays. As well as viewing the runtime custom graphics pages and windows, operators can also access a selection of fixed-format data displays. These include Engineer's specification menus for every function block, operator-configurable historic and realtime trends, alarm summaries, and several (offline) pages of data on utilities, configuration, and system setup. In the 'SEQU' option T1000, a runtime sequence screen is also available for monitoring and interacting with a running sequence (SFC). You can also monitor SFCs in the other T1000 options, but cannot interact with them.

Running a Control Strategy — The Runtime Screen



To run a control strategy and access the runtime screen, you normally press the RUN softkey on the T1000 power-up screen, then select the strategy to be run from the pop-up menu of filenames listed. After a few moments the strategy starts to run, and its first page of graphics (if specified) is displayed together with the runtime softkeys and title bar. Alternatively, if a strategy has been specified in the 'Startup' file (via the UTIL softkey) this strategy will start running automatically at power-up or cold start. Figure 5.1 shows an example of a runtime screen.

NOTE. T1000's *CardWatch* utility will inhibit the RUN softkey — and indeed all the runtime softkeys — and flash an 'Access Denied' message unless the required security level is present, either on an inserted DTU card or in the resident security setup. Refer to Chapter 6, *Utilities: Overview*, for more information on CardWatch.

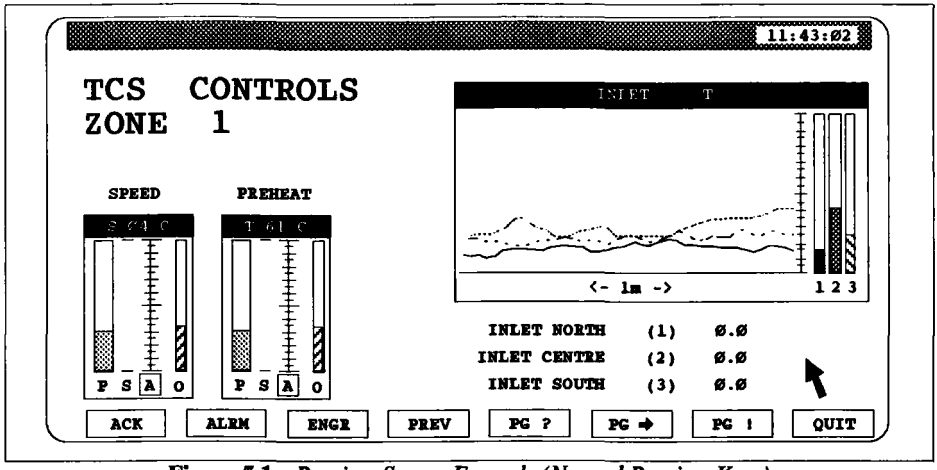


Figure 5.1 *Runtime Screen Example (Normal Runtime Keys)*

Normal Runtime Softkeys

The 'normal' runtime keys, shown in Figure 5.1, are summarised in Table 5.1. Full details are given in Chapter 8. The uses of the normal runtime softkeys are outlined in the following sections.

- **ACK.** Pressing ACK acknowledges the highest priority alarm, shown at the top left of the screen in the message bar. If the alarm has a priority of 6 or over, the alarm message and all the softkeys flash to attract your attention until it is acknowledged, even if the point is no longer in alarm. (Alarms are detailed in the *LIN Blocks Reference Manual*.)

Softkey	Purpose
ACK	Acknowledges highest priority alarm (shown at top of screen in title bar) Also acknowledges all the alarms displayed in the Alarm Summary page
ALRM	Displays the Alarm Summary page (up to 18 alarms)
ENGR	*When linked graphic object highlighted*: Displays Specification Menu of linked function block. *Otherwise*: Lists all function blocks in the strategy. Select one to access its Specification Menu. (With appropriate security clearance you can change data)
PREV	Changes display to previously displayed page (if any)
PG?	Displays list of available page/window titles for operator selection. Also accesses the Long-term Trend facility, runtime Files page, Security setup, and ('SEQU' option only) runtime Sequence screen
PG —>	Displays the 'next page' that was specified in Graphics Configuration (*Defaults to numerical order*)
PG!	*Enabled only when page-pending icon* ! *flashing in screen* message bar: Displays the activated 'pending page' (configured in Control Configuration) with the highest priority. If already on-screen, the next highest is displayed.
QUIT	Quits runtime and returns T1000 to power-up screen.

Table 5.1 *Normal Runtime Softkeys*

Pressing the ACK softkey when you have the *Alarm Summary* page (see next section) on-screen acknowledges all the alarms listed at the same time.

- **ALRM.** The ALRM softkey accesses the *Alarm Summary* page. Figure 5.2 shows an example page. The summary lists all blocks currently in alarm, and also any with unacknowledged alarms of priority 6 or more, even if they are no longer in alarm.

  Entries show the date and time the block first went into alarm, the block tagname, the alarm type, if in alarm, if unacknowledged, and the alarm's priority. Up to eighteen alarms can be indicated on the page, and more can be scrolled to. Specific blocks in the alarm page can be inspected via the ENGR key.

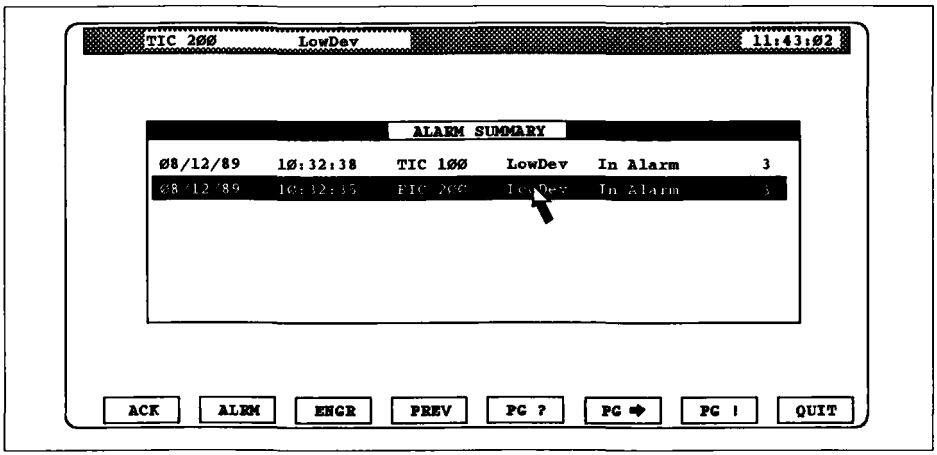


Figure 5.2 *Example Alarm Summary Page*

- **ENGR.** This softkey accesses the Specification Menu ('Engineer's display') for any function block in the control strategy. These menus are intended primarily for operator monitoring, but with higher security clearance they can also be accessed for editing. Then all data fields (except the block *tagname*) can be updated in exactly the same way as is done during Control Configuration (see Chapter 3).

The Page-Handling Softkeys — PREV, PG?, PG→, and PG!. This group of four softkeys is concerned with the screening of T1000 graphics pages (although PG? has some other important functions as well).

- **PREV.** The PREV(ious) softkey displays the graphics page that was on-screen previously to the current one. Pressing PREV again returns you to where you were before, i.e. to the new previous page.

- **PG?.** In the 'CTRL' (Control) option T1000, PG? has four functions: selecting a new page for display, and accessing the longterm historic/realtime trend facility, the historic trend filing page, and the security setup page. In the 'SEQU' (Sequence) option, PG? also accesses the runtime sequence screen and its special softkeys. (Longterm trending is outlined in its own section later in the chapter. The CardWatch security utility is outlined in Chapter 6. The runtime sequence screen is described in detail in the *T1000/T100 Sequence Reference Manual & User Guide*. Please refer there for details.)

- **PG→.** This is a '*next page*' softkey, which makes it easy for an operator to switch from any current graphics page to a particularly relevant follow-on page or window simply by pressing PG→. Follow-on pages are designated during Graphic Configuration via the PAGE softkey.

- **PG!.** This softkey accesses T1000's '*page-pending*' facility. Page-pending allows one of eight pages of graphics to be brought quickly to the operator's attention when an alarm or other specified digital event occurs. Pages are linked to their activating alarms or events during control configuration (via the PAGE block), and are given a priority order to cater for multiple alarm conditions.

  The PG! softkey is enabled only when the *page-pending icon* (!) flashes on and off in the top left corner of the screen's message bar, signifying that at least one pending page has been activated, possibly more. Then, when PG! is pressed, the activated pending page with the highest priority is displayed and the operator can take the necessary action. The icon will continue to flash if other pending pages have been activated by other significant events.

- **QUIT.** This key has the same function as in Control and Graphic configuration, i.e. quitting and returning you to the T1000 power-up screen. To quit runtime, however, the necessary security level must be configured — either on a DTU cardkey inserted in one of the front panel drives, or in the 'resident' security setup.

Other Runtime Softkeys

Graphics Interaction. Other softkeys appear at runtime when you ENTER certain dynamic graphic object on the screen — readouts, bargraphs, faceplates etc. These special keys let you interact, via the objects, with the control strategy variables they are linked to, and are outlined in the section *Interacting with Graphic Objects at Runtime*, below.

Runtime Packages. Alternative softkeys also appear when you press the PG? softkey to call up a new page or to access the trend package, security setup, or ('SEQU' option only) the runtime sequence screen. Figure 7.2 in Chapter 7 — *User Interface: Reference* — schematises the overall T1000 softkey hierarchy, but excludes the special keys associated with graphic object interaction. The trend package is outlined in the section *Longterm Historic & Realtime Trending*, on page 5.8.

Interacting with Graphic Objects at Runtime

ENTERing a Graphic Object. During runtime an operator can, with the necessary security clearance, interact with the control strategy via dynamic graphic objects on the screen — such as controller fascias, readouts, bars, and mini-trends — provided they have been entry-enabled for that operator. Enabling is done during graphics configuration, as outlined in Chapter 4 in the *Graphic Objects* section. 'ENTERing' an object is simply pointing at it with the cursor to highlight it, then pressing the ENTER key (or equivalent mouse or trackerball button).

Types of Interaction. What happens when you ENTER the graphic object depends on the type of object and how it has been configured. Objects that are always *static* graphics (e.g. TEXT, POLYLINE) or that have not been linked to the control strategy, or have not been enabled, simply ignore being selected. Other (*dynamic*) objects respond with either a numeric keyboard, an options menu, a set of new softkeys, a special screen display or a combination of these allowing the operator to select an item or to read and enter data. Table 5.2 summarises the responses of T1000's dynamic graphic objects to runtime entry, and Figures 5.3 and 5.4 show two examples. Details are given in Chapter 8, *T1000 Runtime Interface: Reference*.

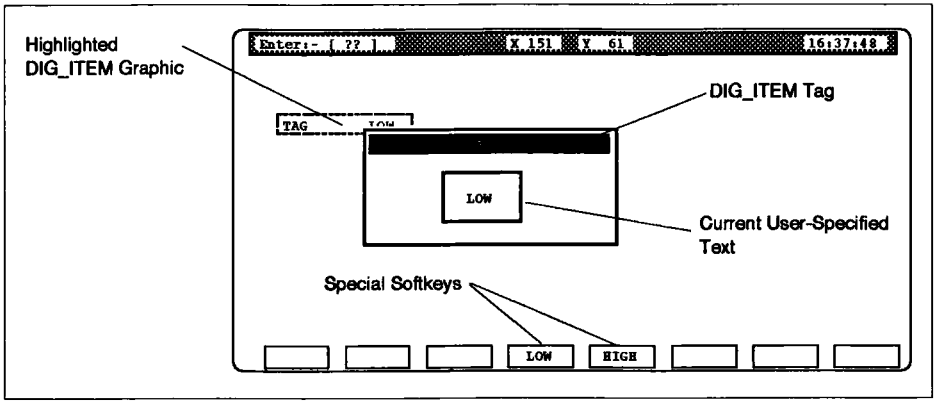


Figure 5.3 *ENTERing a DIG_ITEM Graphic at Runtime*

Graphic	Special Softkeys	Special Display/Response
POLYLINE	*(Static Graphic Object. No response to Entry)*	
CIRCLE	*(Static Graphic Object. No response to Entry)*	
TEXT	*(Static Graphic Object. No response to Entry)*	
READOUT	*None*	Numeric keyboard: 'Enter field value'
CONDTEXT	*None*	Options menu listing the High* & Low* texts
MESSAGE	*(No response to Entry)*	
MENUITEM	*None*	Options menu listing up to 8 specified field values
STEP.X	*(No response to Entry)*	
STEP.T	*(No response to Entry)*	
CONTROL	Rem, Auto, Man, Sp, ↑, ↓	Large front panel with tagname, buttons bargraphs, mode lights, digital readout
ANMAN_ST	Auto, Man, ↑, ↓	*None*
DGMAN_ST	Auto, Man, High*, Low*	*None*
TREND	*None*	Options menu listing 3 available timespans
BAR	↑, ↓	*None*
DIG_ITEM	Low*, High*	Window showing current High* or Low* text
DIGGROUP	*As for individual DIG_ITEMs*	
PAGECHNG	*None*	Accesses page or window specified in the 'Number' field of the PAGECHNG icon
ICON	*(Static Graphic Object)*	Accesses page or window specified in the 'Page' field of ICON
CONDICON	*None*	Options menu indicating High or Low state

* The actual legends are the *user-specified* 4-character High or Low texts

Table 5.2 *Runtime ENTERing of Graphic Objects*

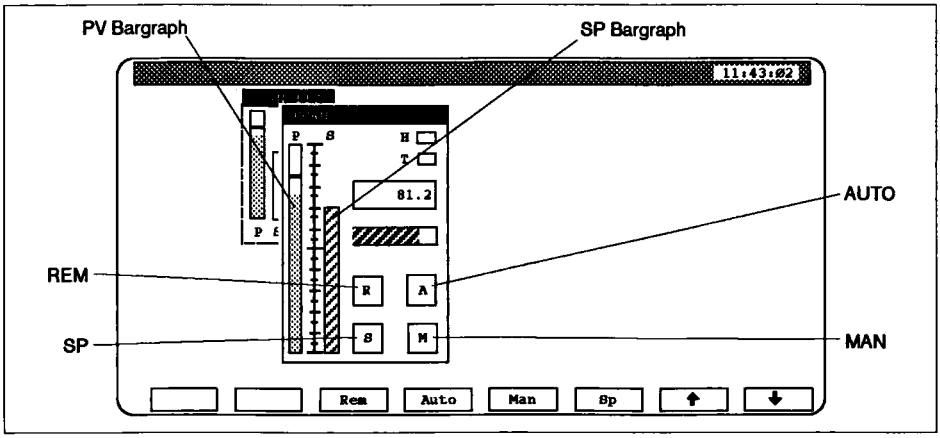


Figure 5.4 *ENTERing a Control Fascia at Runtime*

Longterm Historic & Realtime Trending

T1000's *Longterm Historic & Realtime Trending* package offers the operator a powerful runtime-configurable full-screen trending facility suitable for current and historical trending of both analogue and digital points. On a single trend window you can plot *realtime* data directly from the running control strategy, together with *historic* data, collected in special files by HIST blocks configured in the control strategy. The historic data can originate from the currently running strategy itself or from any history files stored in T1000's RAM area or on data cards.

Accessing the Longterm Trend Window. The longterm trend window is accessed from the normal runtime screen via the PG? softkey. Figure 5.5 shows a window configured with three traces. Two new softkeys — FULL, and STOP — replace the regular PG→ and PG! keys.

Configuring the Longterm Trend Window

You can plot up to three variables at a time in the trend window, which is configured by inputting the appropriate data into each of the fields beneath the plot area. The uses of these data fields are as follows.

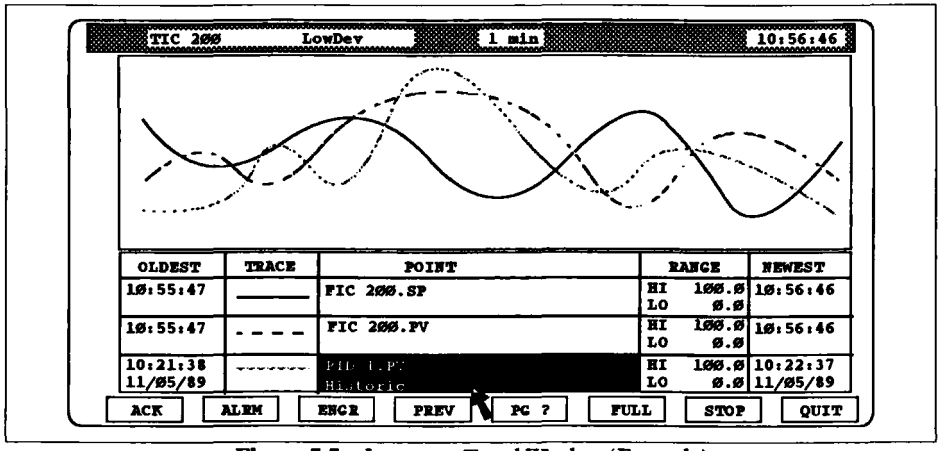


Figure 5.5 *Longterm Trend Window (Example)*

- **OLDEST.** This field shows the time at the left-hand ('oldest') end of the trend, as hours:minutes:seconds. (For historic trends the date is also displayed, as day/month/year.)

- **NEWEST.** Here, the time at the right-hand ('newest') end of the trend is shown. For historic trends the date is also displayed. The difference between the NEWEST and OLDEST times is the *span* of the trend window, displayed at the top of the screen in the message bar. You can alter the trend span via the NEWEST or OLDEST fields by selecting from a list of the available trend span times, ranging from 1 minute up to 24 hours.

- **TRACE.** Shows which of the three available line-styles is being used for each plot: solid, dotted, or dashed. It can also make selected plots invisible, though still being trended — useful when you want a clearer view of a particular trace on its own.

- **POINT.** Shows the names of the currently trended points, displays trend spot values, and can also add or delete trends in the plot area. Displaying spot values is done by moving a line-cursor along the traces to read off corresponding values.

- **RANGE.** Displays the plotted range for each analogue trace. RANGE can zoom and de-zoom (up to 500:1) selected trace ranges, and shift each trace vertically in the plot window. (The FULL softkey offers another way to enlarge the window's vertical scale to fill the entire T1000 screen, so that you can look at traces at maximum detail.)

Freezing a Trace. The STOP softkey, one of the regular longterm trend window softkeys, is used to stop ('freeze') or start selected traces, allowing unhurried examination. When plotting resumes, a trace 'jumps' to its correct position along the time axis, where it would have appeared had plotting not been suspended, and no loss of data occurs during the time the plot is frozen.

Historic Trends

Historic trends obtain their plot data from special HIST function blocks, installed and configured during Control Configuration. At runtime each HIST block collects and files up to ten channels of data from the points it has been 'connected' to in ways defined by parameters in its specification menu. Collection frequencies, data processing, filing areas and so on, can be pre-specified in a HIST block, but you can also 'wire' digital inputs to the block to allow the control strategy itself to modify these parameters at runtime. In the same way, HIST blocks can be switched off and on by the strategy.

NOTE. A maximum of five HIST blocks per T1000 is recommended, to minimise the effect the data logging has on block/display/keypad update performance. It also helps if the HIST blocks save at *staggered* times, e.g. by starting each one separately via a TIMEDATE block.

HIST Files. Each HIST block creates a sequence of special files for storing the data it collects, naming them *Filename*.H*nn*. *Filename* is a user-defined name, which can be altered at runtime via the HIST block's specification menu (*FileName* field). In the extension .H*nn*, *nn* starts at zero for the first history file in the sequence, and is incremented (to base 36) for each new file that needs to be created — .H01, .H02, ...H09, .H0A, ...HYZ, .HZZ, up to a maximum of 36^2 (1296) files. You can specify the maximum size of each history file using the *HistSize* parameter in the SETUP utility (see Chapter 11).

Special Historic Trend Softkeys. When viewing historic trends you can access four special softkeys — PAST, FUTR, TIME, and LOCK — that operate on the trends as follows.

- **PAST.** Shifts the selected historic trend half a span-width backwards in time (if possible), i.e. to the *right* in the window. You can press PAST repeatedly to move backwards in time by half span-widths until the oldest data is on-screen.

- **FUTR.** Similar to the PAST key but works in the opposite direction. Each time you press it the selected historic trend shifts half a span-width forwards in time (if possible), i.e. to the *left* in the window.

- **TIME.** Lets you set the OLDEST time and date values for a selected historic trace via an on-screen keyboard. If you enter a time/date that is not in the history file, the trend times update as closely as possible to your specifications.

- **LOCK.** 'Locks' a historic trend to any realtime trends being plotted, by advancing them across the plot window together. LOCK makes it easy to compare a historic trend with an ongoing realtime trend, by locking them together at an appropriate position.

Chapter 6

UTILITIES: OVERVIEW

This chapter tells you about T1000's five *utilities* — FILES, SETUP, NEW TIME, REMOTE, and SECURITY, accessible via the UTIL softkey on the power-up screen. Utility functions are summarised in Table 6.1, and outlined in the sections that follow. More detail is given in Chapter 11, *T1000 Utilities Interface: Reference.*

Utility	Purpose
FILES	File information/handling: location, size, copy, delete, device format
SETUP	Assigns T1000 LIN node address; specifies control database to be run at cold-start; specifies devices to be scanned for graphics page/window files
NEW TIME	Sets system time and date
REMOTE	Downloads strategies to remote devices on the LIN. Starts/stops remote running
SECURITY	Configures softkey security setups

Table 6.1 *T1000 Utilities*

The FILES Utility

The Files Screen. The FILES utility appears as a 'files screen', with a special set of softkeys, exemplified in Figure 6.1. The files screen lists the files stored in all memory areas in the local instrument, including any data cards inserted in either of T1000's two DTU front-panel drives, A and B. Files in a remote T1000 can also be accessed and listed via the INIT softkey.

Filenames are grouped into seven columns, one for each memory area, headed by icons showing the area codes, and a configurable code (**??::?:**) for remote instruments. (In Figure 6.1, three more columns — ROM, 'Template ROM', and remote files — can only be seen by scrolling the viewing window to the right.)

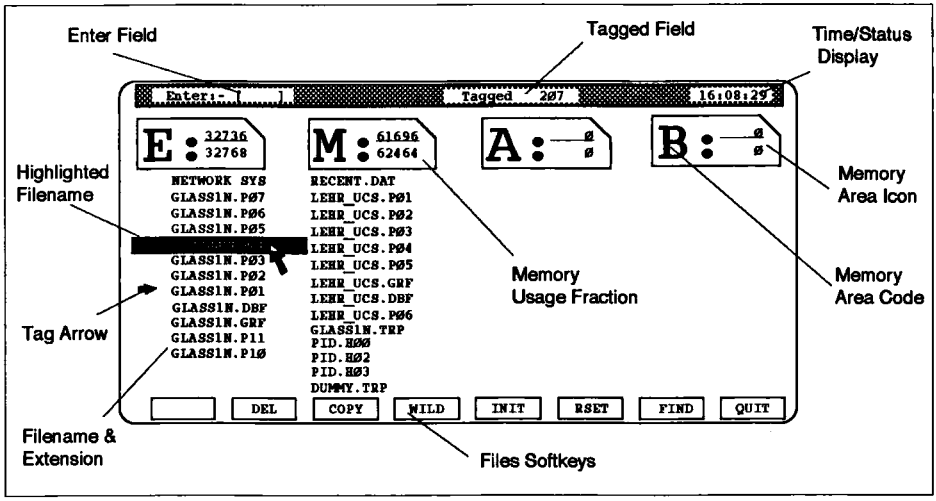


Figure 6.1 *T1000 Files Screen (Part View)*

Memory Usage. Each memory area icon contains a 'fraction' showing its current memory usage above the fraction bar and total capacity below the bar (in bytes). You can find out the size of an individual file, or a group of files, by *tagging* the required file(s) — the total size of any tagged file(s) is always displayed in the Tagged window at the top of the screen.

Filing Operations. Using the FILES softkeys, summarised in Table 6.2, you can carry out a range of filing operations on local and remote files.

- **Deleting & Copying Files.** These operations work on individual or groups of tagged files. Note that with the WILD softkey you can tag all the files in a given memory area having a common root filename (but different filename extensions) — e.g. all the files associated with a particular control strategy.

- **Selective Display of Files.** The powerful FIND key lets you list only files with names matching a character string entered via a pop-up keyboard. You can use '?' to select 'don't care' characters; e.g., T??????? selects all root filenames beginning with 'T'.

Softkey	Purpose
DEL	Deletes tagged files
COPY	Copies tagged files
WILD	Selects groups of files with the same root filename
INIT	Clears & initialises a local memory area. Accesses memory area in remote T1000
RSET	Updates files screen
FIND	Lists filenames by specified characters
QUIT	Returns to the power-up display

Table 6.2 *FILES Softkeys*

T1000 Filenames. T1000 filenames have 8-character *root filenames* with 3-character *extensions*, e.g. FILENAME.DBF. All files associated with a particular control strategy have the same root filename — the name you gave the control strategy when you saved it during Control Configuration. T1000 automatically adds extensions to distinguish the different types of file, e.g. .DBF (parameter databases), .H*nn* (history files), and so on. Other special files are created by the T1000 operating system, e.g. CONFIG.SYS. (Table 11.2 in Chapter 11 lists all the filename types and their purposes.)

The SETUP Utility

SETUP accesses a menu of seven fields: *Node No*, *Segment*, *Startup*, *Del stup*, *Mimic*, *HistMax*, and *HistSize*:

- **Node No** and **Segment** assign the current node address of the T1000 on the Local Instrument Network (LIN), and the particular LIN to which the T1000 is, or will be, attached.
- **Startup** and **Del stup** specify the control strategy (if any) to be run automatically when the T1000 'cold starts'.
- **Mimic** specifies the memory areas to be searched for matching graphics files when a control database is run.
- **HistMax** and **HistSize** limit the number and size of T1000 history files.

Chapter 11 gives full details of how to use and configure these SETUP fields.

The NEW TIME Utility

You use this option, via pop-up keyboards, to set the local T1000's system *date* (Figure 6.2) and *time-of-day*. These values are used in several T1000 functions:

— Message Bar clock
— Alarm Reports screen
— Alarm Log hardcopy
— Longterm & Historic Trending package
— TIMEDATE function block

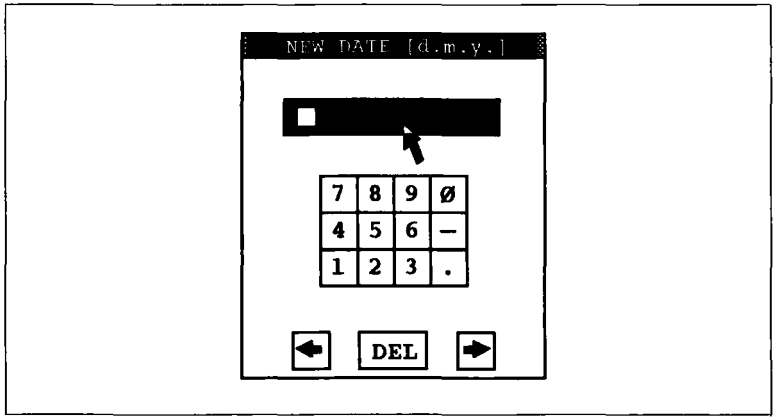


Figure 6.2 *NEW DATE Numeric Keyboard (NEW TIME Utility)*

The REMOTE Utility

This utility lets you download control strategies in the local T1000 to remote devices on the Local Instrument Network (LIN). You can also stop and start the strategy running in a remote device. REMOTE accesses a special set of softkeys:

- **NODE.** Specifies the hexadecimal node address of the remote device you want to communicate with, which then appears in the centre of the message bar at the top of the screen. Figure 6.3 shows the NODE softkeys and pop-up hexadecimal keyboard for entering the required node address.
- **SEND.** Lists all the control strategy filenames in the local T1000, for one to be selected and downloaded to the RAM area of the target remote device. It then automatically starts running.

■ **STOP & GO.** Stops and starts, respectively, the running of the strategy in the RAM area of the remote device.

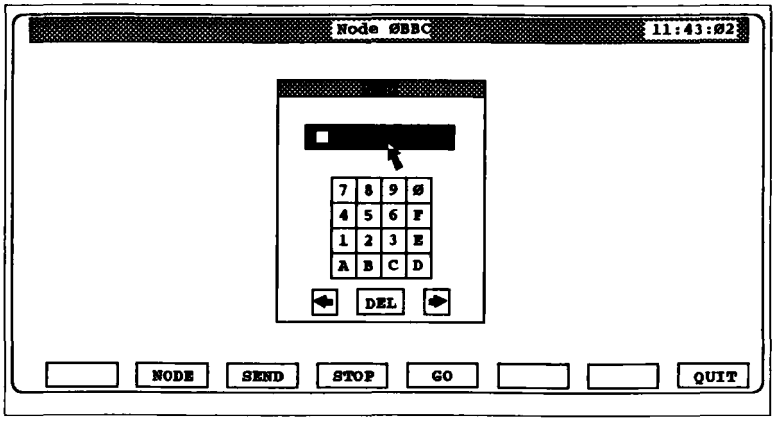


Figure 6.3 *NODE Pop-Up Hexadecimal Keyboard (REMOTE Utility)*

The SECURITY Utility — CardWatch™

The CardWatch Softkey Security System lets you control the access different levels of personnel have to T1000's configurators, utilities, and runtime interface, via security data stored on DTU cards. CardWatch operates both locally and plant-wide. In a mimic, for example, runtime entry of each graphic can be restricted to specified operators. At the same time, security can be tailored to the varied requirements of different instrument groups on the LIN, and of different LIN segments plant-wide.

Security Levels. CardWatch is based on a hierarchy of six *security levels*, each with its own set of 'privilege' softkeys that only it, and higher levels, can use. Generally speaking, low-level access is restricted mostly to runtime operator functions, whereas higher-level users can access database configuration and system setup parameters. (Table 11.4 in Chapter 11 lists the softkeys available to CardWatch's different security levels.)

CardWatch also permits multi-level configuration. For example, a DTU card could be set up to give the holder several different security levels, each for a different group of instruments around the plant according to his areas of responsibility and expertise. Up to eight combinations are possible in a single card.

CardWatch In Action. Whenever a softkey is pressed, CardWatch checks a setup resident in the T1000, and then the setups of any inserted DTU cards, looking for the minimum necessary security clearance to access that particular softkey. If the required clearance is found, access is permitted. If not, CardWatch inhibits the softkey and flashes an 'Access Denied' message.

Configuring Security Setups — The Security Setup Window

Security setups are configured within the SECURITY utility — in a 'security setup' window — and are protected from alteration by a 4-digit 'PIN' security number. Figure 6.4 shows the security setup window with its special set of softkeys; a pop-up 'Users' menu has also been accessed. In the Users menu, each of the letters A to D represents a user who — when set to 'Yes' — is allowed by CardWatch to enter a particular graphic object at runtime.

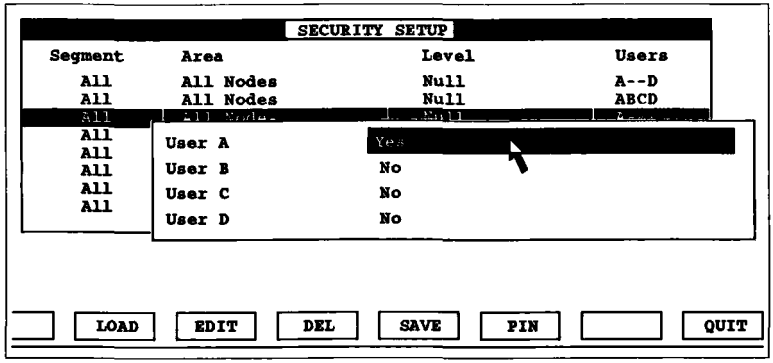


Figure 6.4 *'Users' Pop-Up Menu*

Table 6.3 summarises the security setup softkeys, which are fully described in Chapter 11. The schematic in Figure 5.3 (Chapter 5) shows how the security softkeys fit into the overall T1000 softkey hierarchy.

Softkey	Purpose
LOAD	Screens the DTU A, B, or Resident security setup window for inspection/editing
EDIT	Allows editing of all security setup fields in the loaded window
DEL	Resets a line of security setup values to their default field values
SAVE	Stores a configured setup to the DTU A, B, or Resident security setup file
PIN	Allows the PIN to be changed
QUIT	Returns to the power-up display

Table 6.3 *T1000 Security Setup Softkeys*

Chapter 7

T1000 USER INTERFACE: REFERENCE

This chapter and next four summarise and describe in reference form all the features of the T1000 user interface. The present chapter covers the following:

- Front Panel
- Optional Input Devices
- Power-Up Display
- On-Screen Data Entry.

Chapters 8 to 11 deal with the:

- Runtime Interface
- Control Configuration Interface
- Graphic Configuration Interface
- Utilities Interface

NOTE. Details of the Sequence Configuration Interface can be found in the *T1000/T100 Sequence Reference Manual & User Guide* (Part No. HA 080194 U018).

FRONT PANEL

Figure 7.1 shows the T1000 front panel, with the main features labelled.

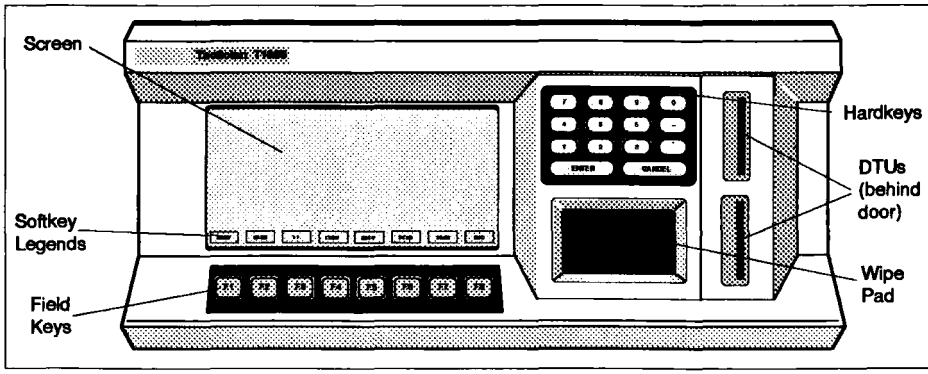


Figure 7.1 *T1000 Front Panel*

Front Panel Features

Screen Displays. Several screen displays are available depending on the T1000 option — Power-Up, Runtime, Historic Trends, and Utilities (all options); Control and Mimic configurators (not DISP option); Sequence Configurator (SEQU option only). Each display has its own set(s) of softkeys, and some of the softkeys access further displays with associated special softkeys. These displays and softkeys are described individually in their own sections below. Figure 7.2 shows schematically the overall T1000 softkey hierarchy.

Wipe Pad. Rubbing the wipe pad surface with the fingertip, using light pressure in the direction required, moves a cursor around the screen display. The distance the cursor travels across the screen is related to the fingertip travel across the wipe pad, though not directly, being affected by the rubbing speed.

Hardkeys & Softkeys. The keypads to the right of the screen are called 'hardkeys' to distinguish them from the 'softkeys', operated by the field keys below the screen, labelled F1 to F8. Softkeys have variable functions, indicated by on-screen legends in rectangular borders just above each keypad. To operate a softkey displayed at the foot of the screen, press the corresponding field key below it. Hardkey functions are invariable and are printed on each key — they comprise a *numeric keypad* with ENTER and CANCEL keys. The hardkeys can be used during configuration and runtime.

Data Transfer Units (DTUs). The pair of drives to the right of the hardkeys accept 32Kb or 128Kb memory capacity 'smart cards' which can be written to or read from. The cards are inserted into the DTUs to allow magnetic transfer of data either way between any T1000 memory area and a card, and also from card to card. Cards must be inserted the right way up, as indicated on their labels, and pushed fully into the drives. Do not move a card whilst it is being accessed or data may be lost.

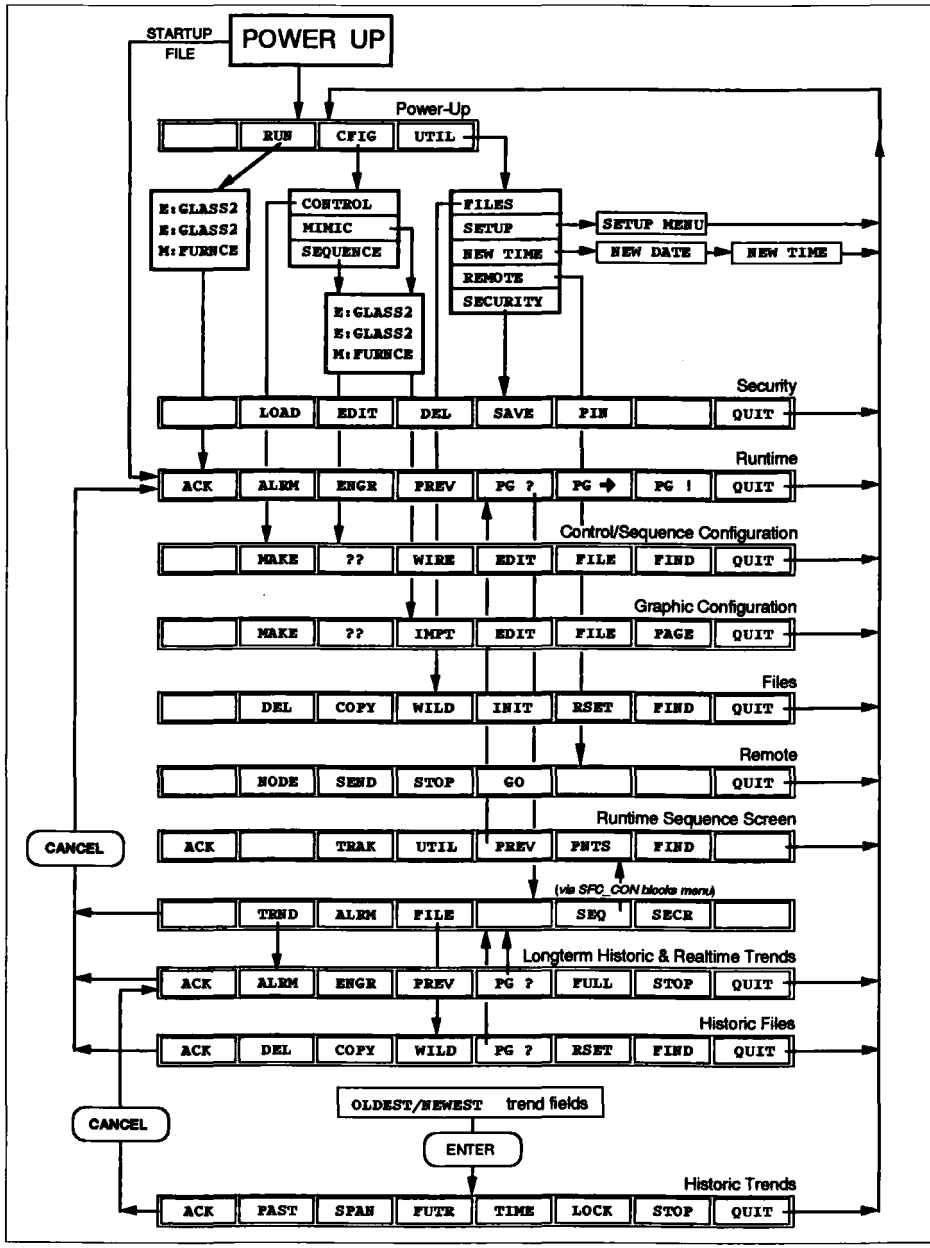


Figure 7.2 *T1000 Softkey Hierarchy Schematic*

OPTIONAL INPUT DEVICES

Two optional input devices are available for connecting to the T1000 to speed up data entry: an optical 'mouse', and an external keyboard with integral trackerball. Either of these devices can be used instead of, or in addition to, the front-panel wipe pad and on-screen keyboards, ***but they must not both be connected to a T1000 at the same time. If they are, neither pointing device will work, and damage could result.*** You can also use other suitably configured character generators to input text to the T1000 — see end of this section.

Mouse

An optical 'mouse' can be connected to the 25-way RS232 socket (Line 2) on the rear panel of T1000. Moving the mouse over its special tablet moves the cursor around the screen more precisely than the wipe pad. Mouse and wipe pad can be used together or as alternatives. The mouse buttons can also be clicked instead of pressing the ENTER and CANCEL *hardkeys*. Click the left button for ENTER and the right button to CANCEL. The middle button has no function. To make softkey selections, click the right button (CANCEL) once (twice if in the middle of an operation) and the cursor 'freezes'. Then, move the mouse left or right to highlight a softkey and click the left button (ENTER) to activate it. The CANCEL operation toggles between a 'free' and 'frozen' cursor.

NOTE. Softkeys cannot be selected in this way at runtime.

Keyboard & Trackerball

An external serial ASCII (full 'Qwerty') keyboard with integral trackerball (EPAL Order No. S9270) can be connected to the 25-way RS232 Line 3 socket on T1000's rear panel.

CAUTION. ***Ensure that the T1000 power is off before connecting or disconnecting the external trackerball keyboard.*** Failure to do so could 'crash' the T1000 and lose an unsaved configuration, or worse, damage the power supply.

The trackerball with its associated keys can be used in place of the wipe pad or mouse at all times. The ASCII keyboard can be used to enter data to any on-screen keyboard window. In the Sequence Configurator it also allows structured text to be entered directly into a text window, bypassing the on-screen keyboard completely.

Trackerball. Roll the trackerball to move the cursor in the corresponding direction. The three unmarked keys above the ball are equivalent to the three mouse buttons, i.e. the left key equates to ENTER, the right key to CANCEL, and the middle key is not used. Softkey selections can also be made (other than at runtime) using the trackerball and its keys, in the same way as for the mouse (described in the previous section).

Keyboard. Key in characters whenever an on-screen keyboard of any type is displayed (decimal, hexadecimal, or alphanumeric). The typed characters appear in the on-screen keyboard window. To input the characters to the database you need only type <Return> or <Enter> on the external keyboard — there is no need to highlight the keyboard window first (as required when using on-screen keyboards alone).

The external keyboard is particularly efficient during *sequence configuration* ('SEQU' option only). To enter structured text into a transition or action window, access the window and position the cursor where you want to enter text. Characters typed on the external keyboard are then inserted directly at the cursor position — there is no need to access an on-screen keyboard.

Some external keyboard keys have special functions to speed up text entry/editing, as listed in the table below. These keys may work differently when used on the single line in an on-screen keyboard window, instead of on a text block in an ST window. Table 7.1 shows these differences.

External Keyb'd Key	Structured Text Window	On-Screen Keyb'd Window
Carriage Return	Terminates line and moves to next. Breaks existing line at cursor position.	Inputs window to database
Backspace	Deletes character left of cursor and backspaces one position.	*(As for ST Window)*
Delete	Deletes character at cursor position.	*(As for ST Window)*
Insert	Inserts space character	*(As for ST Window)*
Cursor Keys (← → ↑ ↓)	Steps cursor around text a character at a time.	*(As for ST Window,* but ← → only)
Page Up, Page Down	Moves view up or down window a page at a time.	*(No effect)*
Home	Moves cursor to start of text window	Moves cursor to start of text line.
End	Moves cursor to end of text window.	Moves cursor to end of text line.
Ctrl-A	Displays menu of database blocknames/fields (as MENU key)	*(As for ST Window)*

Table 7.1 *External Keyboard Special Functions*

Other Devices

Any generator of RS232 format ASCII characters, using 1200 baud, 8 data bits and no parity, can be used to enter text into the T1000. E.g. an RS232 'dumb terminal', or a PC configured to emulate a dumb terminal, together with a separate optical mouse, can be used in place of the TCS trackerball keyboard. Note that substitutes for the TCS trackerball keyboard may not support the full set of key functions (e.g. cursor movement).

POWER-UP DISPLAY

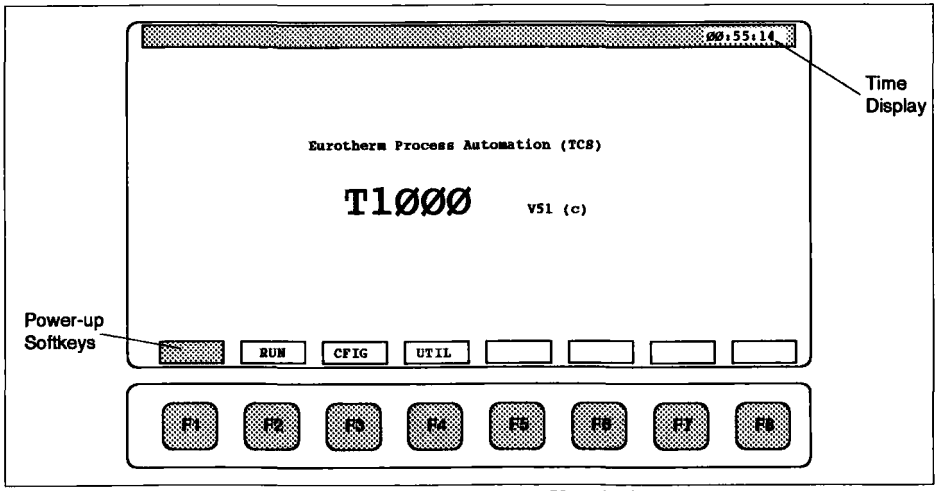


Figure 7.3 *T1000 Power-Up Display*

Display Features

The power-up display is shown in Figure 7.3. This is the screen display seen after a 'cold start' power-up if no control strategy has been specified to run via the SETUP utility. Otherwise, the runtime display for the specified strategy appears instead. The power-up display also appears on escape from any of the other available screen displays, as indicated in Figure 7.2.

Time Display. The current time in *hours: minutes: seconds* shows at the top right corner of the screen, in the message bar. Set this time via the UTIL softkey, or a T1000 function block.

Power-Up Softkeys

Table 7.2 summarises the uses of the power-up softkeys, described individually below.

Softkey	Function
RUN	Runs a selected control strategy
CFIG*	Accesses the Control, Mimic, and Sequence ('S' option) configurators
UTIL	Accesses T1000's utilities

**Not available in the DISP option*

Table 7.2 *The Power-Up Softkey Functions*

RUN Softkey. Press RUN (F2) to see a menu listing the filenames of all the control strategies stored in the T1000's memory areas, including any smart cards inserted in the front panel DTUs. Scroll to a strategy and press the ENTER hardkey. After a few moments of loading-time the strategy starts to run, and its first page of graphics, page 1, is displayed together with the runtime softkeys and message bar. (Note that if there is no page '1' the screen is initially empty, and a page must be accessed for display via the **PG?** softkey.)

NOTE. The T1000 must have a valid LIN address (1 to FE) before a control strategy can be run.

CFIG Softkey. *(Not available in the DISP option).* Press CFIG (F3) to see a menu listing the configuration options — CONTROL, MIMIC, and SEQUENCE ('SEQU' option only). Scroll to an option and press ENTER. With **CONTROL** selected the screen changes to the *Control Configuration Worksheet*, for configuring a control strategy. Selecting **MIMIC** displays a list of control strategy filenames stored in T1000's memory areas. Select and ENTER the strategy to be linked to the new graphics. The list is now replaced by the *Graphic Configuration Worksheet*, where graphics pages are designed and linked. Selecting **SEQUENCE** also displays a list of control strategies. Highlight and ENTER the one to be associated (initially) with the new sequence; the *Sequence Configuration Worksheet* then appears.

UTIL Softkey. Press UTIL (F4) to see a menu listing the Utilities options — FILES, SETUP, NEW TIME, REMOTE, and SECURITY — then select and ENTER one for access. They are described individually in Chapter 11, *Utilities Interface: Reference*, and summarised in Table 11.1.

ON-SCREEN DATA ENTRY

At every stage of T1000 configuration information must be input to database files. This is done via special on-screen *keyboard simulations* which appear when needed, as well as the front panel numeric keypad. The type of keyboard displayed suits the type of data to be input. For selection between a limited number of pre-defined alternatives, T1000 displays 'pop-up' *selection menus.*

Data Fields

The T1000 user interface employs four types of data field: *decimal number, hexadecimal number, alphanumeric character,* and *menu selection.* Some data fields need more than one level of entry to completely specify them, and have further field types nested within. In general data is input to a field by pointing at it with the cursor to highlight it in reverse video, pressing the ENTER hard-key, and then operating on the resulting keyboard simulation, pop-up menu, or nested data field. These operations are described below.

Data Fields & Sub-Fields. Some data fields highlight in reverse video as a single area with a separating bar when pointed at with the cursor. These fields consist of two 'sub-fields': a *value* field and a *units* field. (E.g. **PV** parameter in the PID Control block Specification Menu.) To input data to a sub-field, position the cursor arrow over one of the sub-fields. Although the entire field highlights, pressing ENTER accesses only the sub-field nearest the cursor.

Data Field Responses. Sometimes a numerical value appears in the data field with a different format from the one keyed in. T1000 automatically does decimal place rounding, limiting, and notation changes appropriate to the particular data field being updated. If you have typed an illegal entry (e.g. with two decimal points), attempting its input to the database aborts the process and clears the entry.

NOTE. You must type decimals less than 1.0 with a preceding zero (e.g. **0.8**, not **.8**).

On-Screen Decimal Keyboard

Selecting a decimal number data field displays the on-screen *decimal keyboard* (Figure 7.4) which can be used as an alternative or in addition to the front-panel membrane decimal keypad.

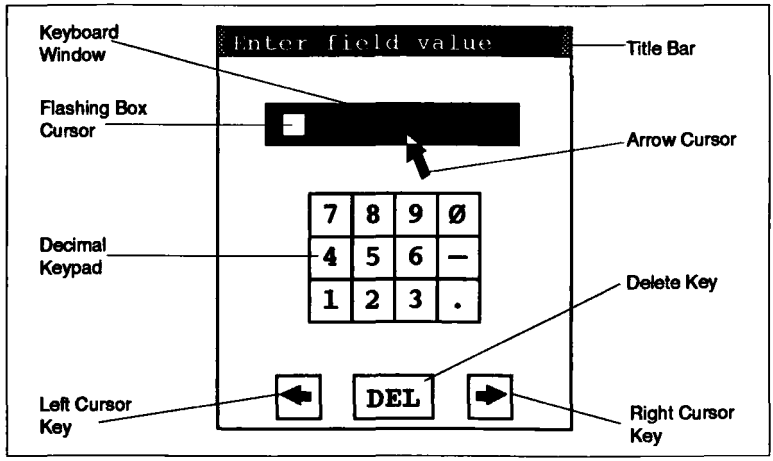


Figure 7.4 *On-Screen Decimal Keyboard*

Title Bar. Instructions to user, and purpose of keyboard.

Keyboard Window. Area where keyed-in characters appear and can be edited. To input the contents of the window to the database, highlight it with the arrow cursor — it displays in reverse video — and press ENTER. The on-screen keyboard disappears and the new data replaces the old in the selected field.

Flashing Box-Cursor. Shows where the next keyed-in character will appear, and overwrite an existing character. The box-cursor advances one place to the right with each character entered, up to the maximum of eight characters. Also shows the character that is deleted if the DEL (Delete) key is used.

Decimal Keypad. Available character set for this data type. To key a character into the keyboard window, point at it with the arrow cursor — it displays in reverse video — and press ENTER.

Left & Right Cursor Keys. Move the box-cursor position to the left or right respectively, allowing overwriting or insertion of characters. Point at the appropriate key (which highlights) and press ENTER once for each single character movement.

Delete Key. Deletes the character at the box-cursor position. Point at the DEL key (which highlights) and press ENTER. The indicated character is deleted and the remainder of the entry (if any) shifts along to the left to close the gap.

Front-Panel Keypad

Figure 7.5 shows the front-panel keypad.

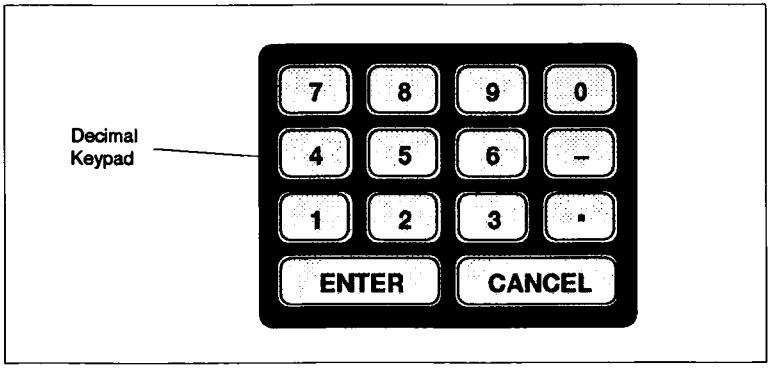


Figure 7.5 *Front-Panel Keypad*

Decimal Keypad. Press these keys to enter characters to the keyboard window, which responds in exactly the same way as for on-screen keyboard entry.

ENTER Keypad. Press to input, action, or access a selected (highlighted) field. Clicking the left-hand mouse button has the same effect.

CANCEL Keypad. Press to close an active keyboard or window, or return to a previous display state. Clicking the right-hand mouse button has the same effect.

On-Screen Hexadecimal Keyboard

Selecting a hexadecimal number data field displays the on-screen *hexadecimal keyboard* (Figure 7.6).

This is used in exactly the same way as the on-screen decimal keyboard, described in the previous section.

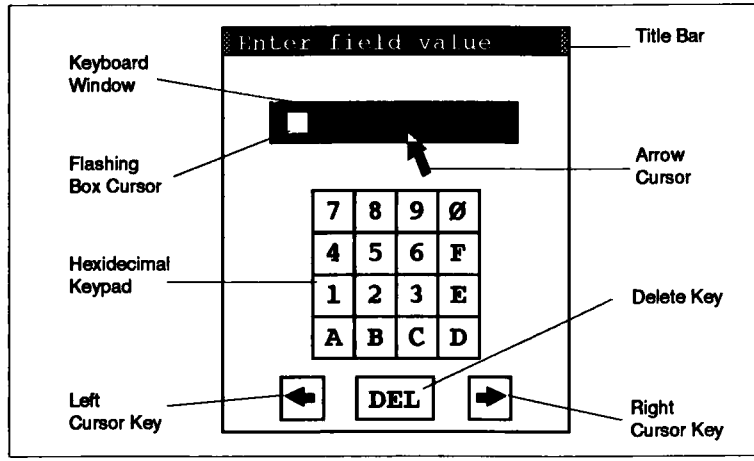


Figure 7.6 *On-Screen Hexadecimal Keyboard*

On-Screen Alphanumeric Keyboard

Selecting an alphanumeric data field displays a full 'Qwerty' keyboard — the on-screen *alphanumeric keyboard* (Figure 7.7).

This is used in exactly the same way as the on-screen decimal keyboard, described in a previous section, but the alphanumeric keyboard has three extra keys: MENU, SPACE, and INS.

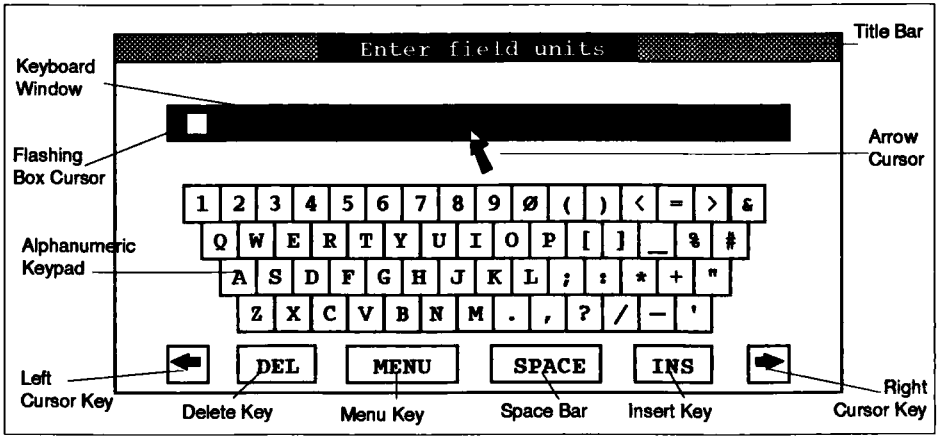


Figure 7.7 *On-Screen Alphanumeric Keyboard*

MENU Key. Helps during control configuration whilst inputting a *tagname* to the **Block** field of a function block via the ?? (Query) softkey. Highlight MENU and press ENTER to see a pop-up menu of common tagnames. Scroll to one and press ENTER; it appears in the keyboard window at the box-cursor position, overwriting any existing characters. MENU also accesses a menu of block tagnames during configuration and runtime when a field or function requiring a tagname is selected. If there are any characters already in the window, MENU adopts a 'wild' function and lists only names starting with these characters — useful with very big strategies.

SPACE key. Works as a 'space bar' to input a space character.

INS key. For inserting characters in the window entry. Locate the box-cursor over the character the inserted text is to precede. Highlight INS and press ENTER once for each character to be inserted. This shifts characters to the right creating spaces for the insertions. Right-most characters are truncated if the maximum entry length is exceeded.

Selection Menus

Entering a menu-selection data field (e.g. **TRUE/FALSE** digital state fields), displays a pop-up *selection menu* listing the choices available. Figure 7.8 shows an example.

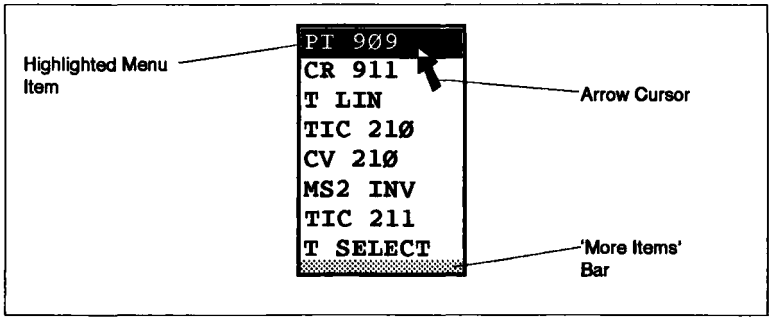


Figure 7.8 *Example Pop-Up Selection Menu*

Scroll to an item to highlight it in reverse video. For more items, point at the shaded bar. Press ENTER; the menu disappears and the selection appears in the data field.

Function Block Specification

To 'parameterise' a function block, access its *Specification Menu* and enter data into the displayed fields as described above. (Specification Menus can be accessed at runtime and at control configuration — refer to those sections for details.) Figures 7.9 and 7.10 show example Specification Menus (ANOP and PID blocks).

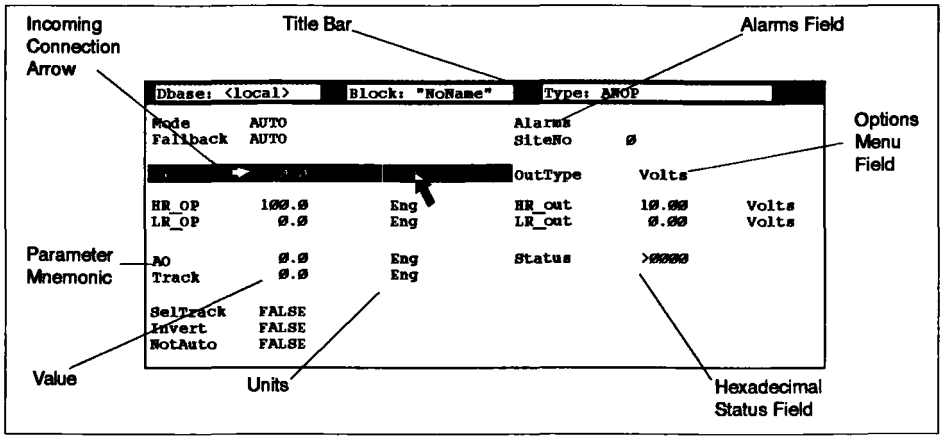


Figure 7.9 *ANOP Block Specification Menu*

Title Bar. Contains three fields common to all Specification Menus: Dbase, Block, and Type.

- **Dbase.** Specifies whether the block is local or cached — i.e. the physical location of the block database. A local block runs in the instrument where its database is, or will be finally, located (e.g. a T100 or T1000). Its Dbase field is set to **<local>**, the default value. A cached block is a local 'image' of a remote block, i.e. a block running in another instrument on the LIN, that allows interaction with the remote block. In a cached block, Dbase specifies the name of the remote database containing the 'real' block. This must have the same name as its T100 or T1000 header block tagname — the *Block* parameter).

  To locate the database and its runtime software in another suitable networked instrument, enter Dbase to access a pop-up menu of three fields — *Dbase*, *Node*, and *Rate ms*. Highlight and enter the *Dbase* name (default = <local>) to see a menu listing **<new>**, **<local>**, and any other existing database names. Select an existing database, or <new> to display an alphanumeric keyboard in which you enter a valid database name, followed by its *Node*, as prompted.

NOTE. For the system to run correctly, a database of the selected name must reside at the specified node, and must contain a corresponding real block of the same type as the local cached block.

Rate ms. Usually, the *Rate ms* field is enterable only for remote blocks — i.e. Dbase not **<local>**. You can enter a single value in milliseconds to specify the minimum update period (i.e. maximum rate) at which an individual cached block is transmitted across the Local Instrument Network (LIN). The default is 10ms minimum, i.e. 100Hz maximum, and can be set between 10ms and 64s. Note that rate values are minimum update times only, and heavily loaded networks may not be able to reach the faster update rates.

Local S6000 Blocks. The *Rate ms* field is, exceptionally, enterable in S6000 category blocks with a **<local>** *Dbase*. In this case, selecting *Rate ms* pops up a further menu containing *Rate ms* and *MPP ratio*. Here, *Rate ms* tells the T1000 how often (in multiples of 200ms) to enquiry poll the S6000 instrument. If you leave it as zero, the T1000 polls the instrument once per second.

MPP ratio specifies how often a multiparameter polling sequence is done. With *MPP ratio* = 0, T1000 polls the instrument using enquiry polls exclusively, which can read only a limited set of parameters. If *MPP ratio* = 1, T1000 uses multiparameter polls only, to read all the available parameters. This should be avoided for performance reasons. For all other *MPP ratio* values (in the permitted range of 2 - 99) T1000 tries to do one multiparameter poll after every *<MPP ratio>* enquiry polls.

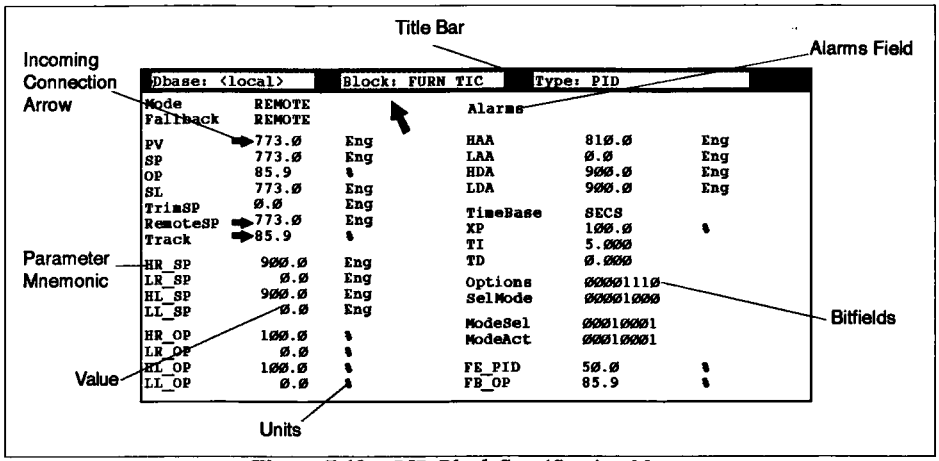


Figure 7.10 *PID Block Specification Menu*

NOTE Certain types of instrument do not support the enquiry polling mechanism for general parameters. With such instruments, or if GEN_COMM blocks are being used to pick up non-enquiry pollable parameters from any instrument, you should set *MPP ratio* = 1.

- **Block.** Contains the user-defined (8-character maximum) block tagname, which identifies and distinguishes it from other blocks of the same *Type*. The default is **"NoName"**. The tagname appears as a label on the block icon, below its type name. Note that a strategy cannot be saved unless all blocks have been tagnamed.

- **Type.** The read-only Type field displays the function block type name mnemonic, e.g. ANIN, PID, SIM, etc. which also appears as a label on the block icon, above its tagname.

Parameter Mnemonic, Value, Units. Most Specification Menu fields highlight in reverse video as a single three-column field containing the read-only *parameter mnemonic* followed by two separately accessible read/write sub-fields: *Value*, and *Units*. The sub-fields are updated as already described. Read-only parameters are not cursor-selectable.

Initially, most data fields have default values and units. If you specify particular units for a parameter, the units for all related parameters in the menu change automatically to the new specification. If you delete all the characters in a units sub-field (including space characters), the field and all related fields revert to their common default value.

Incoming Connection Arrow. A small 'arrow' to the left of a parameter value means that it is being updated by an incoming connection from another block in the strategy, making it effectively read-only. ENTER the parameter to pop up a window showing the source of the connection.

Alarms Field. ENTERing this field displays a menu listing alarm *name* (e.g. HighAbs), *status* (e.g. 'In Alarm'), and *priority* (0 to 15). Only the priority field is editable.

'Combined' Hexadecimal Fields. These fields combine a set of up to 16 two-state parameters into a single field of hexadecimal digits. They are marked with a '>' sign and contain either two or four hexadecimal digits called C and D, or A, B, C, and D, respectively, from left to right. ENTER the field to see the full list of corresponding parameter mnemonics and their states. Digit D shows the hex value of the top four items in the list. It is calculated as the hex equivalent of the binary number formed by the four parameter values (TRUE = 1, FALSE = 0), with the first item the least significant bit.

Digit C similarly shows the hex value of the next four items, and so on in sequence. Blank lines in the list are spare positions and count as 0. Read/write parameters in the list can be ENTERed and their states changed via the resulting pop-up TRUE/FALSE menu.

Bitfields. These fields combine a set of up to eight two-state parameters into a single eight-digit binary number. ENTER the bitfield to see a full list of corresponding parameter mnemonics and their states. The top of the list corresponds to the right-most (least significant) bit in the bitfield, the rest following in sequence with TRUE = 1, FALSE = 0. Blank lines in the list are spare positions and count as 0. Read/write parameters in the list can be ENTERed and their states changed via the resulting pop-up TRUE/FALSE menu. Any incoming connections to parameters are shown in the mnemonic list by arrows.

Options Menu Fields. ENTERing these fields (e.g. Mode, TimeBase) displays an options menu listing all possible field values. Select and ENTER the required value.

Chapter 8

T1000 RUNTIME INTERFACE: REFERENCE

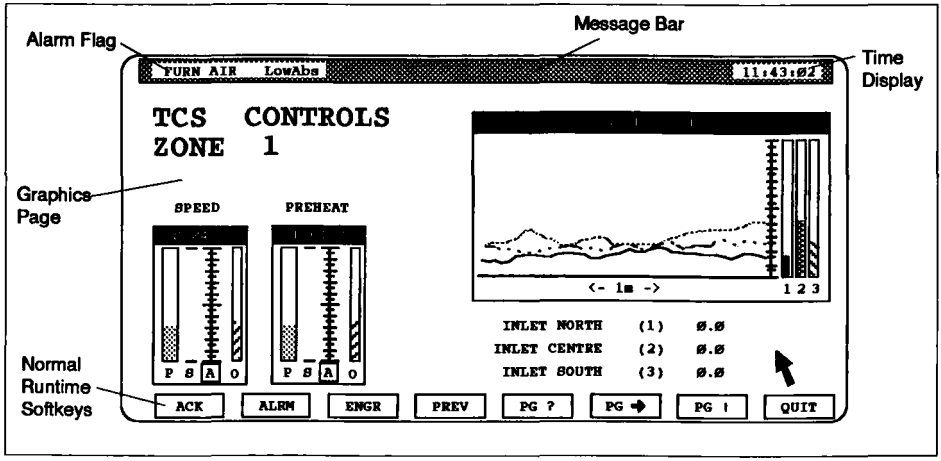


Figure 8.1 *T1000 Normal (Initial) Runtime Screen Display Example*

The *Runtime Interface* operates whilst the control strategy is running and lets an operator monitor and interact with the strategy and the controlled plant via the runtime graphic displays and softkeys. Figure 8.1 shows the normal (initial) *Runtime Display*, with an example graphics page on the screen.

The runtime display can be accessed via the power-up display's RUN softkey, or automatically at cold start via the SETUP utility. Figure 7.2, in Chapter 7, showed this schematically.

Runtime Display Features

Alarm Flag. The Combined Alarm with the highest priority in the whole strategy is displayed. If the alarm has a priority of 6 or over, the alarm message and all the softkeys flash to attract attention until it is acknowledged, even if the point is no longer in alarm. (T1000 Alarms are described in detail in the *LIN Blocks Reference Manual.*)

Time Display. The current time in *hours: minutes: seconds*. Set via the UTIL softkey, or a T1000 function block.

Normal Runtime Softkeys

Table 8.1 summarises the uses of the normal runtime softkeys. Other sets of softkeys appear during runtime on accessing the different types of dynamic graphic object on the screen. These are described in later sections.

Softkey	Function
ACK	Acknowledges highest priority Combined Alarm (shown at top of screen in message bar). Also acknowledges all the alarms displayed in the Alarm Summary page
ALRM	Displays the Alarm Summary page (up to 18 alarms)
ENGR	*When cursor is over a linked graphic object:* Displays Specification Menu of linked function block. *Otherwise:* Lists all function blocks in the strategy. Select one to access its Specification Menu. (Engineer's card key lets you change any data)
PREV	Changes display to previously displayed page (if any)
PG?	Displays list of available page/window titles for operator selection. Also accesses the Long-term Trend facility, runtime Files page, runtime Sequence screen ('SEQU' option only), and the Security setup
PG —>	Displays the 'next page' that was specified in Graphics Configuration. *(Defaults to numerical order)*
PG!	*Enabled only when page-pending icon ! flashing in screen title bar:* Displays the activated 'pending page' (configured in Control Configuration) with the highest priority. If already on-screen, the next highest is displayed
QUIT	*Enabled only if Engineer's card-key inserted:* Quits runtime and returns T1000 to power-up screen.

Table 8.1 *Normal Runtime Softkeys*

The functions of the normal runtime softkeys are explained in the following sections.

ACK Softkey. Press ACK (F1) to acknowledge the highest priority alarm, shown at the top left of the screen in the message bar. All the alarms in the corresponding block are acknowledged as well. If the alarm has a priority of 6 or over, the alarm message and all the softkeys flash to attract attention until it is acknowledged, even if the point is no longer in alarm. (T1000 Alarms are described in detail in the *LIN Blocks Reference Manual.*)

Pressing the ACK softkey when the *Alarm Summary* page (see next) is on screen acknowledges *all* the alarms listed at the same time, if the cursor is in the Summary window. If outside, only the message bar alarm is acknowledged. Again, all the alarms in a block are acknowledged, not just those displayed. Note: alarms in blocks not actually on-screen are *not* acknowledged.

ALRM Softkey. Press ALRM (F2) to display the *Alarm Summary* page. Figure 8.2 shows an example. The summary lists all blocks currently in alarm, and also any with unacknowledged alarms of priority 6 or more, even if they are no longer in alarm. If a block has more than one type of alarm qualifying for listing in the summary, only the alarm with the highest priority is listed.

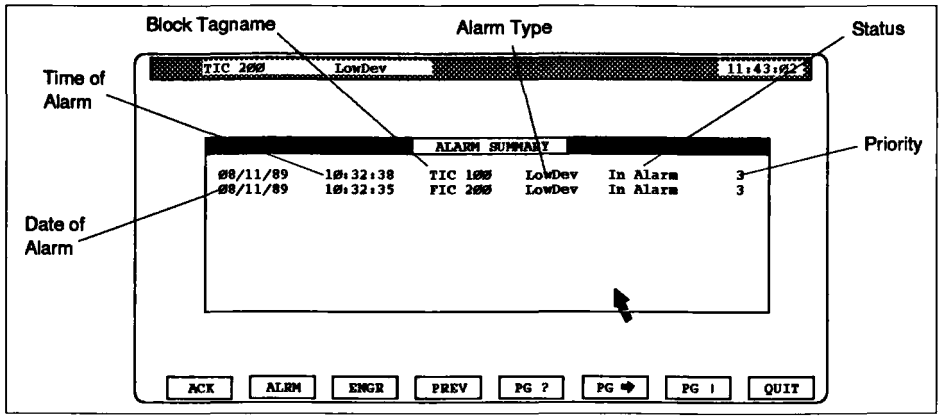


Figure 8.2 *Alarm Summary Page (Example)*

Each entry shows the date and time the block first went into alarm, the block tagname, the alarm type, if in alarm, if unacknowledged, and the alarm's priority. Up to eighteen alarms can be indicated on the page. Press ENTER to move to the next page if more than 18 alarms are active, otherwise, the alarm page scrolls automatically at approximately one minute intervals. Press ALRM again to get back to first page. Press CANCEL to return to the graphics page that was on-screen when the ALRM softkey was pressed.

To look directly at the Specification Menu of a block listed in the Alarm Summary page, highlight the entry and press the ENGR softkey. The block's parameters can now be accessed, and individual alarms cleared or acknowledged, etc.

NOTE. If a printer is connected at runtime, alarm information is output as it occurs. A line printer (not a whole-page printer such as a laser printer) should be used.

ENGR Softkey. Press ENGR (F3) to access the Specification Menu ('Engineer's display') for any function block in the control strategy. These menus are normally locked but they can be unlocked by inserting a card-key with the appropriate security level into the front-panel DTU. Then all data fields (except the block *tagname*) can be updated in exactly the same way as is done during Control Configuration. (See the *Security Utility* section in Chapter 11 for details of security access.)

To access a Specification Menu point the cursor at an empty area between the graphic objects on the screen and press ENGR. A pop-up menu lists all the blocks in the strategy. Select and ENTER one to see its Specification Menu on the screen, ready to be monitored or updated. Alternatively, press ENGR again to access a pop-up keyboard into which a name can be entered. The MENU key can also be used in conjunction with the keyboard to get a restricted pop-up list. Attempting to update a field without a card-key of the appropriate security level inserted flashes an **'ACCESS DENIED'** message. Press CANCEL to return to the menu.

If the block is linked to a graphic object currently on-screen, point at the linked object directly and press ENGR. For most objects, linked to a single block, the Specification Menu is displayed immediately. For free-format 'mini-trends' which may be linked to up to three different blocks, pressing ENGR displays a menu listing the linked block tagnames. ENTER one to access its Specification Menu. Press CANCEL to return to the runtime page.

NOTE. If you ENTER an input field (with an 'incoming connection arrow') to see its source, the the Specification Menu's fields do not update while the connections menu is open.

PREV Softkey. Press PREV (F4) to display the graphics page that was on-screen previously to the current one. (If the current page has been the *only* page displayed so far, since runtime started, the softkey is ignored.) Pressing PREV again returns the display to the new previous page. PREV does not recall a graphics *window*, even if it was the previously displayed item. Instead, the last full page that was on-screen is recalled. (Specification Menus are not recalled with PREV.)

PG? Softkey. PG? (F5) has up to five functions: selecting a *new page* for display, accessing the longterm historic/realtime *trend* facility, the runtime trend *filing* page (not 'DISP' option), the runtime *Sequence Screen* ('SEQU' option only), and the *Security setup* page.

NOTE. Pressing PG? has no effect if no graphics pages have been configured for the control strategy.

- **New Page.** Press PG? to see a pop-up menu listing all graphics page titles. Scroll to a title and press ENTER to display it. If the new page is a *window*, the current page is not displaced, just overlaid by the window, which appears near the current cursor location. Pressing CANCEL removes the last recalled window from the screen.

- **Long-term Trends.** Press PG? to access a new set of softkeys: TRND, ALRM, FILE, SEQ, SECR. (ALRM has its usual function.) Press TRND (F2) to see the *Longterm Trend* display. Longterm trending is described later.

- **Runtime Trend Filing Page.** (Not 'DISP' option). Press PG? to access the FILE softkey, then press FILE to display a filing page like the one in the FILES utility, except that only historic trend files (with .Hnn extensions) in the M: memory area are listed (although the area icons still show the total bytes in use). You can delete the oldest history file to make room for another without having to quit runtime. If you try to delete a different file the message **'Delete Warning — Open files are not deletable'** appears and the operation aborts. Press CANCEL to return to the normal runtime display.

- **Runtime Sequence Screen.** (Not 'DISP' option). Using the PG? softkey to access the Runtime Sequence Screen is described fully in Chapter 5 of the *T1000 /T100 Sequence Reference Manual & User Guide*. Please refer there for details.

- **Runtime Security Screen.** Press PG?, then SECR, to see the default security setup. Press the LOAD softkey and select a security setup for inspection only. CANCEL restores the normal runtime page.

PG —> Softkey. Press PG —> (F6) to display the page designated as the 'next page' during Graphic Configuration (via the PAGE softkey). If no 'next page' was designated, the page with the next highest number appears. If the current page *is* the one with the highest number, the cycle starts again with the lowest numbered page. A *window* cannot have a 'next page', although it can itself be designated as one. (CANCEL clears a window from the screen.)

PG! Softkey. PG! (F7) accesses T1000's *'page-pending'* facility, which screens one of eight graphics pages on a specified digital event. (PG! is configured during Control Configuration via the PAGE block. Pages are linked to activating events and given priorities in case of multiple event conditions.)

PG! is enabled only when the *page-pending icon* (!) flashes on and off in the top left corner of the screen's message bar, signifying that at least one pending page has been activated and is not currently on-screen. Then, when PG! is

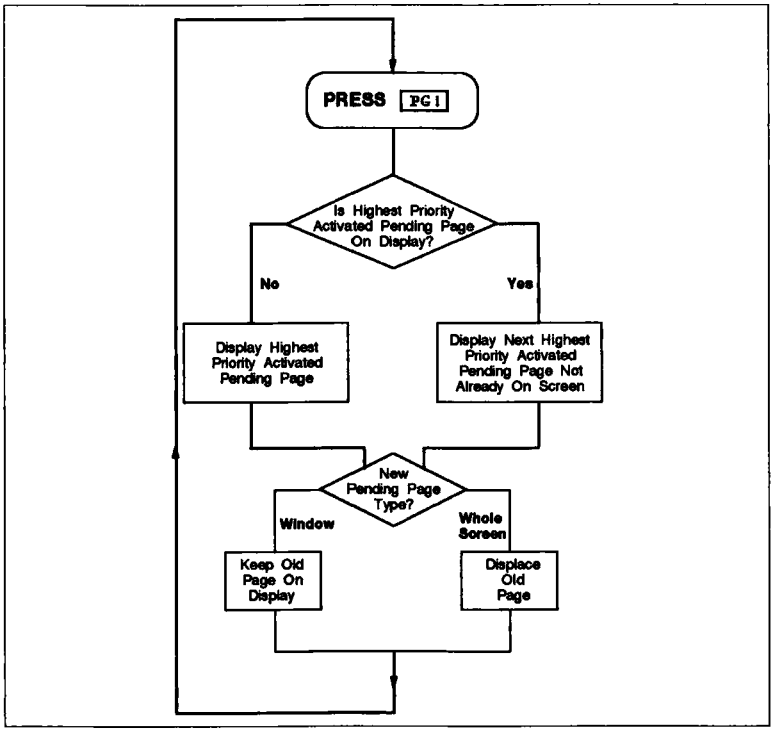


Figure 8.3 *Page-Pending Display Priorities*

pressed, the activated pending page of highest priority is displayed. If this was the only pending page active, the ! icon disappears.

If ! persists, pressing PG! displays the activated page of next highest priority. This displaces the current page, unless the new page is a *window*, which overlays the current page. With only full pages in the strategy, pressing PG! toggles between the two highest priority activated pages. The situation is summarised in Figure 8.3.

QUIT Softkey. With a card-key of appropriate security level inserted in one of the front panel DTUs, press QUIT (F8) to quit runtime and return to the T1000 power-up screen. Without adequate security access, T1000 flashes an **'ACCESS DENIED'** message; press CANCEL to return to the normal runtime screen. Before the quit is executed the message **'Are you sure?'** appears. Press ENTER to complete the operation, or CANCEL to abort it.

Graphics Pages & Windows

Apart from the message bar at the top of the screen and the softkeys along the bottom, the runtime display consists of the currently selected *graphics page*, which fills the screen. It can also contain any number of *graphics windows*, which are inset on the graphics page and cover only part of the screen. (Graphics pages and windows are created during graphic (mimic) configuration, described in a later section.) Changing the displayed page or superimposing windows is done via the page-changing softkeys, described above in the *Normal Runtime Softkeys* section. Page/window changes can also be triggered via the PAGECHNG and ICON graphic objects (described below).

Initial Runtime Graphics Page. When runtime is first accessed the graphics page initially displayed is *page 1*. If there is no 'page 1', no page appears at all initially. One must then be accessed via the PG? softkey.

Graphic Objects. Graphics pages and windows contain *graphic objects* of two basic types: *static*, and *dynamic*.

A **static** object is a fixed graphic that can be used to represent the unchanging parts of a plant mimic, etc. It does not change appearance during runtime and cannot be interacted with by the operator. An exception is the ICON graphic object which is static but can be 'entered' at runtime to trigger a page-change.

A **dynamic** object is linked to a point in the control strategy and changes appearance with changes in the point's value. It can therefore be used to *monitor* a control strategy variable. (Certain graphic objects, the FASCIAS, link to and monitor a *set* of points.) Dynamic objects can be 'entered' at runtime (if enabled during graphic configuration), allowing the operator to access and possibly *alter* the value of the linked point(s). An exception is the dynamic PAGECHNG graphic which can only monitor its linked point.

Note that a dynamic object behaves as a static object if it is left unlinked to any point(s) in the control strategy.

Entering Graphic Objects at Runtime

To 'enter' a graphic object, point the cursor at the object — it highlights with a dotted border if interaction with it is possible — and press ENTER. Provided the appropriate security level clearance is present (on an inserted DTU card, or in the resident setup) you will be able to interact with the object via the special displays and/or special softkeys that appear. These are listed in Table 8.2, and detailed in the descriptions following. Press CANCEL to return to the normal runtime display.

Static objects (except ICON), and dynamic objects that have not had their 'Enter' fields set to *yes*, do not respond to operator entry. Table 8.2 applies to entry-enabled dynamic objects. Dynamic objects that have not been linked to the control strategy cannot access parameter values, though they do respond to operator entry if enabled.

Graphic	Special Softkeys	Special Display/Response	Page
POLYLINE	*(Static Graphic Object. No response to Entry)*		
CIRCLE	*(Static Graphic Object. No response to Entry)*		
TEXT	*(Static Graphic Object. No response to Entry)*		
READOUT	*None*	Numeric keyboard: 'Enter field value'	8.9
CONDTEXT	*None*	Options menu listing the High* & Low* texts	8.9
MESSAGE	*(No response to Entry)*		
MENUITEM	*None*	Options menu listing up to 8 specified field values	8.9
STEP.X	*(No response to Entry)*		
STEP.T	*(No response to Entry)*		
CONTROL	Rem, Auto, Man, Sp, ↑, ↓	Large front panel with tagname, buttons bargraphs, mode lights, digital readout	8.9
ANMAN_ST	Auto, Man, ↑, ↓	*None*	8.12
DGMAN_ST	Auto, Man, High*, Low*	*None*	8.12
TREND	*None*	Options menu listing 3 available timespans	8.12
BAR	↑, ↓	*None*	8.12
DIG_ITEM	Low*, High*	Window showing current High* or Low* text	8.13
DIGGROUP	*As for individual DIG_ITEMs*		
PAGECHNG	*None*	Accesses page or window specified in the 'Number' field of the PAGECHNG icon	8.13
ICON	*(Static Graphic Object)*	Accesses page or window specified in the 'Page' field of ICON	8.14
CONDICON	*None*	Options menu indicating High or Low state	8.14

* The actual legends are the *user-specified* 4-character High or Low texts

Table 8.2 *Runtime ENTERing of Graphic Objects*

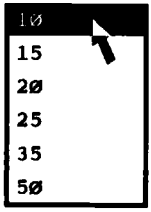
READOUT Graphic

ENTERing a READOUT dynamic field displays an *on-screen decimal keyboard* entitled 'Enter field value'.

Using this keyboard is fully described in Chapter 7. To change the linked point value, type in and ENTER the new value required. If the linked point is being driven via a connection in the control strategy you may not be able to alter its value.

CONDTEXT Graphic

ENTERing a CONDTEXT dynamic field displays an options menu listing the 'High' and 'Low' texts that were specified during graphic configuration. To change the state of the linked point, move the cursor over the required text and press ENTER. If the linked point is being driven via a connection in the control strategy its state may not be alterable.



MENUITEM Graphic

ENTERing a MENUITEM dynamic field displays a pop-up options menu listing (up to) eight parameter values specified during graphic configuration (as *Value_0 to Value_7*). These items can be textual or numeric. The pop-up menu lists only the items configured — fields that were left blank in the MENUITEM entry window do not appear.

To assign a value to the linked database point, highlight the value in the pop-up menu and press ENTER. The menu disappears and the actual updated current point value is displayed in the MENUITEM field. This may not be the same as the value selected from the menu (e.g. if the point is being driven to a different value by a connection from the control strategy, or if F_AUTO overrides an attempt to assign REMOTE, etc.).

If the value selected from the pop-up menu is invalid (e.g. numeric for a mode field) the menu 'pops up' again until a valid selection has been made. At any time, pressing CANCEL clears the pop-up menu without making an assignment.

CONTROL Fascia Graphic

ENTERing a dynamic CONTROL fascia displays a simulated front panel of a standard TCS dual bargraph controller. Six special softkeys also appear — Rem, Auto, Man, Sp, ↑, and ↓. Figure 8.4 shows an example. The special softkeys and the dynamic features of this display are described in the following sections.

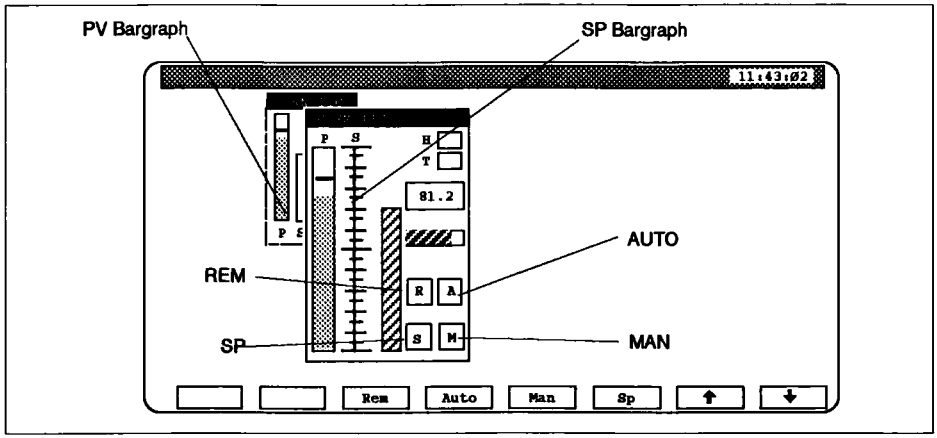


Figure 8.4 *ENTERing a Control Fascia*

CONTROL Softkeys. The first four (Mode and Setpoint keys) — Rem, Auto, Man, and Sp — correspond to the four square front panel 'pushbuttons', labelled **R, A, S, M**, respectively. You can operate only the keys that have been individually enabled for entry during graphic configuration. The last two softkeys (↑ and ↓) represent 'raise' and 'lower' pushbuttons, respectively, and are used in combination with the other four.

- **Rem Softkey.** The **Rem** (Remote) softkey works like the front panel 'R' or 'RAT' pushbutton on a TCS controller. Press **Rem** to select the REMOTE (setpoint) mode of controller operation. The front panel **R** key becomes shaded when Remote mode is active. (The mode actually adopted will be Forced Automatic if Remote is not enabled.) With **Rem** pressed the digital readout displays the controller output in engineering units.

- **Auto Softkey.** This works like the front panel 'A' pushbutton on a TCS controller. Press **Auto** to select AUTOMATIC (local setpoint) mode. The **A** key is shaded when Auto mode is active. In Forced Automatic mode the **A** key flashes on and off. With **Auto** pressed the digital readout displays the controller output in engineering units.

- **Man Softkey.** This works like the front panel 'M' pushbutton on a TCS controller. Press **Man** to select MANUAL mode. The front panel **M** key is shaded when Manual mode is active. In Forced Manual mode the **M** key flashes on and off. With **Man** pressed the digital readout displays the controller output in engineering units. Raise or lower the controller output using the **Man** and ↑ or ↓ keys together: see below.

- **Sp Softkey.** Pressing **Sp** on its own displays the *resultant setpoint* SP in the digital readout, in engineering units. (This works like the front panel 'SP' pushbutton on a TCS controller, except that there the *local* setpoint is displayed.) The front panel **S** key is shaded whilst the softkey is pressed. Raise or lower the local setpoint using the **Sp** and ↑ or ↓ keys together: see below.

- **↑ Softkey.** The 'Raise' softkey works like the corresponding front panel pushbutton on a TCS controller. Pressed together with the **Man** or **Sp** softkeys it raises the controller output or local setpoint, respectively, with an accelerating action.

- **↓ Softkey.** The 'Lower' softkey works like the 'Raise' softkey, except that it *lowers* the controller output or local setpoint.

For more information on controller modes, please refer to Chapter 12 of this manual, *Control loop operating modes*, and to the *LIN Blocks Reference Manual* in the *Control Function Blocks* section.

PV & SP Bargraphs. These display the Process Variable (PV) and Resultant Setpoint (SP), respectively, in %. On the PV bargraph short horizontal lines mark the High and Low Absolute Alarm values. On the SP bargraph similar lines mark the High and Low Deviation Alarm PV limits. The vertical scale between the two bars runs from 0% (bottom) to 100%, with minor divisions every 5%.

HOLD & TRACK Indicators. The boxes marked **H** and **T** indicate when the controller is in HOLD or TRACK mode, respectively, by being highlighted with shading, like the two yellow LEDs on a TCS controller front panel. (Both modes may be indicated, but HOLD overrides TRACK, which becomes the fallback or 'suppressed' mode.)

Digital Readout. The Digital Readout display has sign and decimal point. It corresponds to the front-panel red LED display on a TCS controller. With no buttons 'pressed' the digital readout displays the *process variable* PV, in engineering units. While the **S** button is pressed the *resultant setpoint* SP is displayed in engineering units. With either the **M**, **A**, or **R** buttons pressed the *controller output* OP is displayed in percentage units.

Horizontal Output Bargraph. The output bargraph corresponds to the yellow 10-segment LED bargraph on TCS controllers, indicating the controller's approximate output percentage. The scale runs from zero on the left (empty bar) to full output on the right (bar fully cross-hatched).

ANMAN_ST Fascia Graphic

ENTERing an ANMAN_ST (Analogue Manual Station block) fascia displays a new set of softkeys: Auto, Man, ↑, and ↓. (Refer to Chapter 10 for a description of the ANMAN_ST graphic.)

Auto, Man Softkeys. Press to put the manual station into AUTO or MANUAL mode, respectively. If selected, TRACK mode is not overridden by these softkeys.

↑ & ↓ Softkeys. In MANUAL mode, press to raise or lower the *output*, subject to any rate limiting etc. configured in the linked function block. (In AUTO mode the output follows the input automatically, subject to configured rate limiting etc.)

DGMAN_ST Fascia Graphic

ENTERing a DGMAN_ST (Digital Manual Station block) fascia displays a new set of softkeys: Auto, Man, 'high text', and 'low text'. The two 'texts' are the 4-character High and Low messages specified during graphic configuration.

Auto, Man Softkeys. Press these softkeys to put the digital station into AUTO or MANUAL mode, respectively.

'High Text', 'Low Text' Softkeys. In MANUAL mode you can switch the block output (indicated by **O** on the fascia graphic) to high or low using the corresponding softkeys. In AUTO mode the output follows the input (**I**) automatically.

TREND Graphic

ENTERing a TREND graphic displays an options menu listing in order the three available timespans specified during graphic configuration (A, B, and C). Select and ENTER the required span, which the TREND window then adopts.

BAR Graphic

ENTERing a BAR displays a pair of new 'Raise' and 'Lower' softkeys (↑, and ↓).

↑ & ↓ Softkeys. What happens when these keys are pressed depends on whether the point linked to the bar is *analogue* or *digital*.

For a linked analogue point, pressing the keys increases or decreases, respectively, the value of the point, and also the filled area of the bar representing that

value. For a linked digital point, pressing the '↑' key switches the point to 'high' and fills the bar completely with the configured shading. Pressing '↓' switches the point to 'low' and empties the bar.

Note that if the linked point is being driven via a connection in the control strategy its value may not be alterable.

DIG_ITEM Graphic

ENTERing this graphic displays a window showing the current user-specified 'high' or 'low' text and also a new set of softkeys: 'low text', 'high text'. Figure 8.5 shows an example.

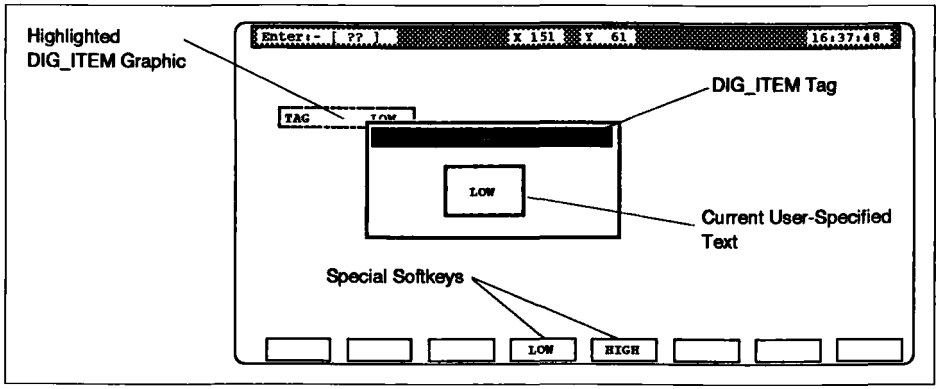


Figure 8.5 *Example DIG_ITEM Graphic*

'High Text', 'Low Text' Softkeys. Press the required softkey to set the state of the linked point. Note that if the linked point is being driven via a connection in the control strategy its value may not be alterable.

DIGGROUP Graphic

Each digital item in a DIGGROUP graphic behaves like an individual DIG_ITEM. See previous section.

PAGECHNG Graphic

ENTERing this graphic displays the page or window specified in the 'Number' field of the PAGECHNG icon during graphic configuration. A newly displayed *page* displaces the current runtime display, but a *window* appears as an inset to the current display. If no page number, or a non-existent one, was specified, ENTERing a PAGECHNG graphic has no effect. Note that this graphic can be ENTERed whether or not its linked digital is 'high', making it flash.

ICON Graphic

ICON is a *static* graphic object but, exceptionally, it does respond to entry by displaying the page or window specified in its 'Page' field during graphic configuration. If no page or a non-existent one was specified, entry is ignored.

CONDICON Graphic

ENTERing CONDICON displays a menu listing 'High' and 'Low', with the cursor automatically positioned on the state that the linked digital could be switched to. Just press ENTER to do this. Note that if the linked point is being driven via a connection in the control strategy its state may not be switchable.

Longterm Historic & Realtime Trends

This T1000 package allows trend plots of analogue and digital points to be set up during runtime. *Realtime* data can be plotted directly from the running control strategy, together with *historic* data collected in special files by HIST blocks configured in a control strategy. The historic data can originate from any strategy, either currently running or run earlier.

Accessing the Trend Display

To access the Longterm Historic & Realtime Trend display from the normal runtime screen, first press the **PG?** (F5) softkey to obtain a new set of softkeys that includes: TRND, ALRM, FILE. (**PG?** is ignored if no graphic page was configured.) Then press the **TRND** (F2) softkey. The trend display appears with two of the regular softkeys (PG—> and PG!) replaced by the special softkeys FULL and STOP. Figure 8.6 shows a longterm trend window with three trends configured, and the *arrow* cursor in the lower part of the display. The display becomes the *line* cursor version when the cursor is in the upper part; Figure 8.7 shows an example.

Trend Display Features

Alarm Flag. This message works as already described for the runtime interface (see page 8.1).

Span. *Span* is the time-width of the trend plot, and is the difference between the values shown in the NEWEST and OLDEST fields. It defaults to 1 minute but can be set to 1, 10, or 30 minutes, or 1, 2, 4, 8, or 24 hours, via either of these two fields (see below). Span must be the same for all three plots, whether realtime or historic. Realtime trends advance across the plot area from right to left at the rate of 1/60th of the window width every 1/60th of the span time.

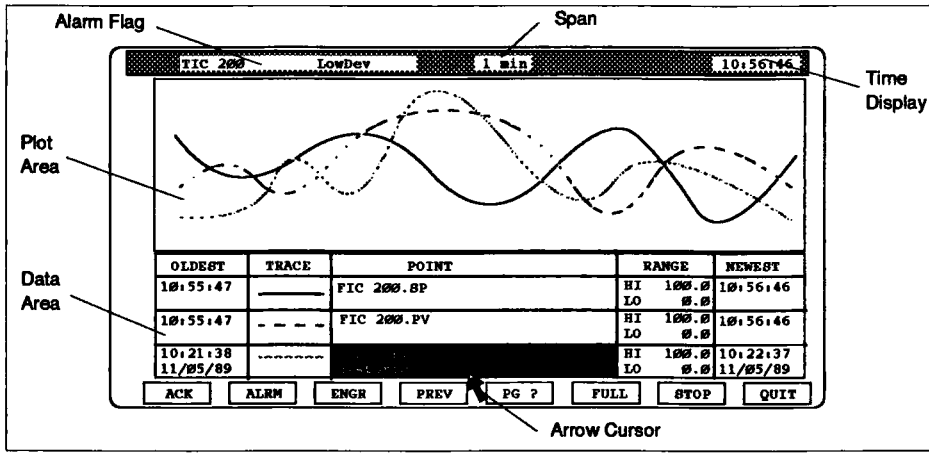


Figure 8.6 *Example Longterm Trend Window (Arrow Cursor)*

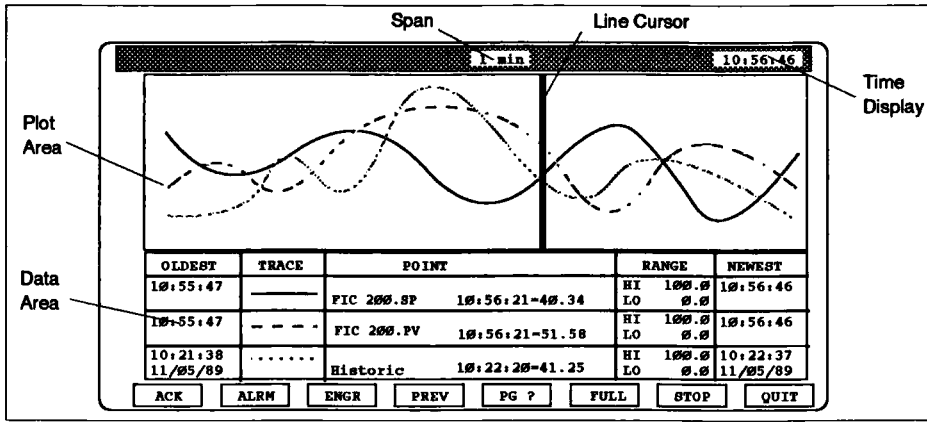


Figure 8.7 *Example Longterm Trend Window (Line Cursor)*

Time Display. This message works as already described for the runtime interface (see page 8.1).

Plot Area. Upper area of the trend display where plots normally appear.

Data Area. Lower area of the trend display containing three sets (in rows) of data fields relating to the three trends in the plot area. The columns define five trend properties: OLDEST, TRACE, POINT, RANGE, and NEWEST.

Line Cursor. When in the plot area the cursor appears as a vertical line that can be moved across the trends. Values at the points where the line intersects the trends are continuously displayed in the corresponding POINT fields (see below).

Arrow cursor. When in the data area the cursor appears in its regular arrow form for field selection. To select a data field, move the cursor onto the field — it highlights in reverse video — and press ENTER.

Trend Special Softkeys FULL and STOP

FULL Softkey. Press to enlarge the vertical scale of the plot area to fill the entire screen. The data fields disappear to make room for the expanded trend display, and the FULL softkey changes to HALF. Full-screen trends keep all their half-screen view settings, but the cursor is disabled. Press the HALF softkey to return to half-screen view.

STOP Softkey. Select a trend by locating the cursor in any of its data fields and press STOP to stop ('freeze') it. Stopped trends cease being updated in the trend window, but no data is lost. The STOP softkey changes to GO; any or all trends can be stopped. As different trends are highlighted, the STOP/GO softkey changes appropriately.

To freeze all trends at once (global stop), move the cursor into the *plot area* and press STOP. Press GO to unfreeze all the trends globally stopped, but not any *individually* stopped. To unfreeze an individually stopped trend, highlight any of its data fields and press GO. Restarted trends reappear in their correct positions on the time axis, without loss of data.

Data Area Field Displays

OLDEST Data Fields. Shows the time at the left-hand ('oldest') end of the trend, as hours:minutes:seconds (e.g. **13:57:55**). For historic trends the date is also displayed beneath the time, as day/month/year (e.g. **13/Ø7/89**).

TRACE Data Fields. Shows the line-style in use for the corresponding plot: solid, dotted, or dashed.

POINT Data Fields. Shows the name of the point being trended in 'compound format' to make its origin clear (e.g. **PID.SP**, or **PID.Alarms.HighAbs**). For historic trends the label '**Historic**' is displayed beneath the point name. With the cursor in its *line* form the POINT field also

contains the *time* and corresponding plot *value* at the point intersected by the cursor (e.g. **11:37:22 = 9.525**). Digital values are shown as High or Low (e.g. **12:Ø9:46 = Low**).

RANGE Data Fields. Shows the high (HI) and low (LO) scale values to four significant figures precision for each analogue trace, that is, its plotted range (e.g. **HI 1ØØ.Ø LO Ø.ØØØ**). For a digital point the field displays '**Digital**'. The trend package takes range values from the block database, if possible, using the High and Low Range parameters, and initially plots the full range of the data. Otherwise default values of 0.000 to 100.0 (%) are used. A *group* of RANGE fields can be selected by highlighting each field and pressing ENTER to add it to the group. Pressing ENTER again de-selects the field.

NEWEST Data Fields. This column shows the time at the right-hand ('newest') end of the trend, as hours:minutes:seconds. For realtime trends this is also the *current* time. For historic trends the date is also displayed beneath the time, as day/month/year.

Interacting with Data Fields

To interact with a data field, 'enter' it by selecting it with the arrow cursor — it highlights in reverse video — and then press ENTER. The trend display responds in various ways allowing the operations described next.

Altering Trend Span. Enter either the OLDEST or NEWEST fields of any *realtime* trend. A menu of span times appears (1 min - 24 hr). Scroll to the required time and press ENTER to implement it.

Entering a *historic* trend OLDEST/NEWEST field displays a set of special softkeys: ACK, PAST, SPAN, FUTR, TIME, LOCK, STOP, and ESC. (ACK, STOP, and ESC have their usual functions; the others are described in the next section.) Press the SPAN softkey to see the menu of span times, then implement a time as for a realtime trend. Afterwards, press CANCEL to free the cursor from the column of fields and return to the normal trend softkeys.

Altering Historic Trend Time Windows. The oldest/newest times and dates of a historic trend can be altered via the special trend softkeys — PAST, SPAN, FUTR, TIME, and LOCK — accessed by entering the selected trend's OLDEST or NEWEST data field. Press CANCEL to return to the regular trend keys and free the cursor. Note that the *span* of a historic trend (NEWEST – OLDEST) must always be the same as for the realtime trends, but the OLDEST *absolute* value can be set to any time/date associated with the logged historic time-stamped data. The special softkeys work as follows.

- **PAST Softkey.** Press to shift the selected historic trend half a span-width backwards in time (if possible), i.e. to the *right* in the window. If the trend window is already showing the oldest data in the file, or is nearly at that position, the PAST key is ignored or has only a limited effect.

- **SPAN Softkey.** (Already described under *Altering Trend Span*, above.)

- **FUTR Softkey.** Works in the opposite direction to the PAST key. Each time it is pressed the selected historic trend shifts half a span-width forwards in time (if possible), i.e. to the *left* in the window.

- **TIME Softkey.** Allows the OLDEST time and date values for a selected historic trend to be set. Press to display an alphanumeric keyboard showing current values. Amend as required and ENTER the data. If a time/date that is not in the history file is entered, the trend times update as far as possible.

- **LOCK Softkey.** Advances the selected historic trend across the plot area at the same rate as a realtime trend (1/60th of the window width every 1/60th of the span time). I.e., it 'locks' the historic trend to any realtime trends. The historic trend 'unlocks' when it has advanced as far as the filed data allows. Pressing the LOCK softkey changes its legend to UNLOCK. Pressing UNLOCK reverts the historic trend to the normal static display.

Concealing a Trend. Enter the TRACE field of the trend to be concealed. It vanishes from the plot area and its TRACE field empties, although the concealed plot is still actually being trended (and can be accessed by the line cursor in the usual way). To restore the trend to view, re-enter its TRACE field. The trend and its line-style bar re-appear.

Adding a Realtime Trend to the Window. Enter a POINT field. If it is empty a menu appears listing the items: RealTime and (not 'DISP' option) Historic. If full, another item (Clear) is included. Select and ENTER **RealTime** to see a list of blocks in the strategy. Select and ENTER the required block — a list of its points appears from which the point to be trended is selected. (For some compound points, e.g. *Alarms*, a further selection is needed.)

Adding a Historic Trend to the Window. Enter a POINT field and select and ENTER **Historic**. A list of T1000 memory areas appears (RAM = M:, DTU drives = A: and B:). EEPROM cannot be accessed directly for trending history files and is not listed. Select and ENTER the required memory area to see the root filenames (HIST block *FileName*) of all history files stored there.

Select and ENTER the required file. After the message **Searching for data ...** a list of logged points appears; select one to be trended and press ENTER. An on-screen keyboard appears displaying the default start date and time of the trend (i.e. the earliest logged sample). Edit these if required, and press ENTER to implement the historic trend.

Removing Trends from the Window — All Trend Types. Enter the occupied POINT field, scroll to the **Clear** option and press ENTER. The trend and its data fields are deleted completely from the display (not just concealed).

Altering Plot Range. Enter the RANGE field of the trend. Some new softkeys appear — IN, OUT, RSET, ↑, and ↓. To re-range a *group* of trends, highlight the RANGE field of each one and press ENTER to add it to the group. Pressing ENTER again removes it from the group. The special re-ranging softkeys function as described next but have no effect on *digital* trends. To escape the RANGE function press CANCEL which frees the cursor and restores the regular trend softkeys.

- **IN Softkey.** 'Zooms' the selected trends, reducing the plot range by a factor of two each time it is pressed. Trend(s) are automatically centred in the trend window. Traces zoom up to nine times — magnifying the scale by approximately 500.

- **OUT Softkey.** 'De-zooms' the trends by a factor of two each time pressed. This *increases* the plot range.

- **↑ & ↓ Softkeys.** Move the plot range of the selected trend(s) up- or down-scale, respectively, without altering the range span (HI – LO). This shifts the trend position down or up, respectively, in the plot window. (These keys work only on traces that have been zoomed.)

- **RSET Softkey.** Resets the plot range of the selected trend(s) to the initial default values, i.e. the full-range of the variables or the 0 - 100 default range.

Chapter 9

T1000 CONTROL CONFIGURATION INTERFACE: REFERENCE

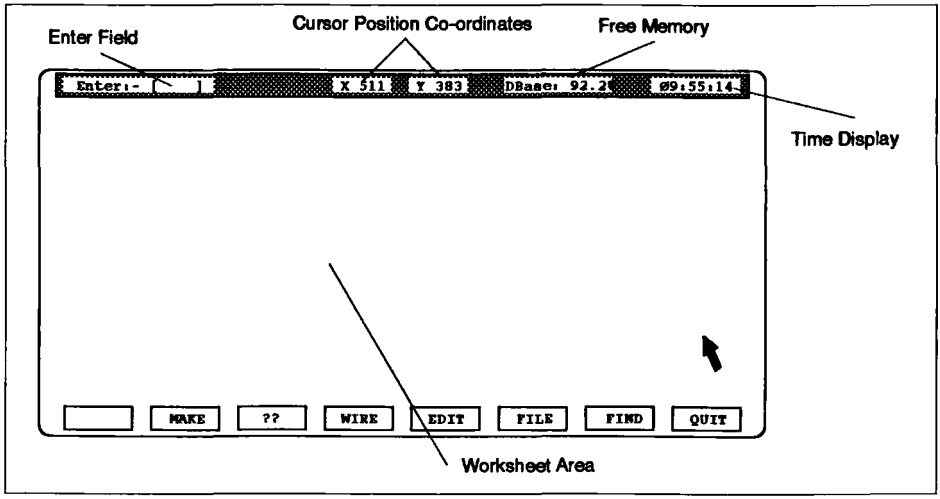


Figure 9.1 *T1000 Control Configuration Worksheet*

The Control Configuration Interface (not available in the 'DISP' option T1000) is implemented as an on-screen 'worksheet' where the control part of a strategy is configured using T1000's block-structured approach. To access the *control configuration worksheet*, press the CFIG softkey in the power-up display to see the options CONTROL, GRAPHIC, and ('SEQU' option only) SEQUENCE. With CONTROL highlighted, press ENTER and the worksheet appears, as shown in Figure 9.1.

Control Configuration Display Features

Enter Field. Shows the last (currently) selected *softkey* operation in the square brackets, e.g. **Enter:— [MAKE]**, or the last *menu option* selected, e.g. **Enter:— [MOVE]**, or the last *block* to be placed, e.g. **MAKE PID**. Pressing the ENTER keypad actions the current selection, without having to reselect it.

Cursor Position Co-ordinates. X and Y are in pixels relative to the top left corner of the worksheet.

Free Memory. This field displays alternately two legends during control configuration — 'DBase' and 'Graph':

- **DBase.** Indicates the percentage memory remaining for the control database. This area is used to store block parameters, expressions, etc. The DBase percentage figure flashes if it falls below 5% to warn you that the database is nearly full. An error message '**No free database memory**' appears if you attempt to go over the limit. To reduce the database memory used, delete blocks or connections, or eliminate non-default engineering units from block Specification Menus.
- **Graph.** Indicates the percentage memory remaining for the control worksheet layout, i.e. the blocks and wiring graphics. To reduce graphics memory usage, delete blocks, connections, or angles in connections.

  Pressing CANCEL, ENTER, and most of the configuration softkeys, toggles the free memory display between 'DBase' and 'Graph'.

NOTES. Take care not to reach the limits of free memory! Try to keep at least 1% spare, and save regularly as you approach the limit.

Database memory usage in v5 software has been optimised to allow more blocks and connections to be run in a strategy. It is therefore possible that a large configuration created in v5 will not run with earlier software. In this case reduce the memory used as indicated above.

Time Display. The current time in *hours: minutes: seconds*. Set via the UTIL softkey, or a T1000 function block at runtime.

Worksheet Area. Where the function blocks in a control strategy are positioned, interconnected, and parameterised. The overall worksheet size is 1024 pixels wide by 768 high, with a visible window of about 500 x 200 pixels, i.e. about 1/7th of the total area. To see the rest of the worksheet, move the cursor off the edge of the screen, which then 'auto-scrolls'.

When first accessed the worksheet is empty, ready for a new configuration. An existing configuration can also loaded to the worksheet (for modification) from a memory area or DTU card via the FILE softkey's LOAD option.

Control Configuration Softkeys

Table 9.1 summarises the uses of the control configuration softkeys, described in later sections.

Table 9.1 *T1000 Control Configuration Softkeys*

MAKE Softkey. MAKE (F2) accesses T1000's *function block library*, summarised in Table 3.2, Chapter 3. Function blocks appear on the worksheet as box-shaped icons representing the operations on the digital and analogue input and output signals flowing through a control strategy.

Initially, for an empty worksheet, pressing MAKE displays a *limited* menu listing the three CONFIG blocks (T1000, T100, and T231). These are special 'header' blocks defining the type of unit that will execute at runtime — a T1000, T100, or T231, respectively. Subsequently, pressing MAKE displays the *full* list of block categories.

Header block icons have distinctive 'double' outlines, and at least one such block must be placed on the worksheet before configuring the rest of the strategy. For consistency, always position the header block in the same position on the worksheet — e.g. the top centre. Note that the tagname specified in the Block field of the header block defines the name of the corresponding database in the network; it is this name you refer to when caching blocks to other databases. You can subsequently delete a header block, to run the strategy in a different instrument, but then the MAKE menu will again force the creation of a new header block before letting you proceed.

T1000, T100, and T231 blocks are not exclusively header blocks — they can be created and then cached (via the Dbase field) to collect data from other units on the network. Cached block icons have single 'thin' borders to distinguish them from regular local blocks and from the header block. A header block cannot be cached; its Dbase field is read-only, fixed at **<local>**.

■ **Placing a Function Block on the Worksheet.** Press MAKE to see the list of categories (or the CONFIG blocks for a new strategy). The menu box is not tall enough to show the full list; point at the narrow shaded bar at the bottom or top of the menu to see the hidden ones. Highlight a category and press ENTER. A sub-menu appears listing the function blocks in the chosen category. Highlight and ENTER a block. It appears on the screen as a rectangular dotted outline that is moved around using the wipe pad (or mouse). Position the block outline then press ENTER (or the left mouse button) to 'paste' it down. To place other block types, press MAKE to return to the menu for another selection. The blocks all appear with the default name **"NoName"**. To cancel a menu selection before placing the block on the worksheet, press CANCEL (or the right-most mouse button).

NOTE. Running most 'foreign' block templates locally — e.g. downloaded via LINtools — in a T1000 can cause malfunctions and should be avoided. (Table 1-2 in the *LIN Blocks Reference Manual*, Part No. HA 082 375 U003, lists the blocks that T1000 supports.)

?? (Query) Softkey. Used to display and/or enter data associated with *function blocks*, *compounds*, and *wires*. Press **??** (F3), locate the cursor on the object to be 'queried' and press ENTER. Press CANCEL to clear the query display and return to the normal worksheet view.

■ **Querying Function Blocks.** The block's *Specification Menu* appears. This is a page showing all the configurable parameters for that block. Inspect and/or enter values for all or some of the block parameters; i.e. *parameterise* the block; the data is stored in the strategy database file. Figure 9.2 shows a typical block menu (ANOP). Inputting data to a Specification Menu is described in Chapter 7, under *On-Screen Data Entry*. To query blocks inside a *compound* first zoom the compound; see next section.

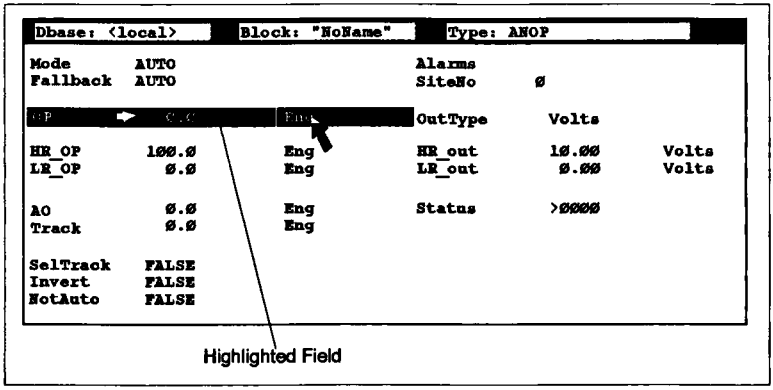


Figure 9.2 *Typical Function Block Specification Menu (ANOP)*

■ **Querying Compounds.** The compound's *Compound Menu* appears, with three fields: Zoom, Type, and Name. Highlight and ENTER the required field:

Zoom shows the contents of the compound on the worksheet, displacing the normal strategy display. The QUIT softkey appears as 'OUT'. Query/edit blocks and wiring in the usual way. Press OUT to return to the normal worksheet view.

Type specifies/edits an 8-character (maximum) '*typename*' for the compound. The default is CMPND. Edit if required via the displayed alphanumeric keyboard.

Name specifies/edits an optional 8-character (maximum) individual *tagname* for the compound via the displayed alphanumeric keyboard.

■ **Querying Wires.** A menu of all the connections in the selected wire or 'bus' appears with sources on the left and destinations on the right, headed by the two block tagnames. The list is read-only; it cannot be used to edit connections. Figure 9.3 shows an example connections menu.

To query wiring inside a *compound* first zoom the compound to show its contents; see previous section under *Zoom*.

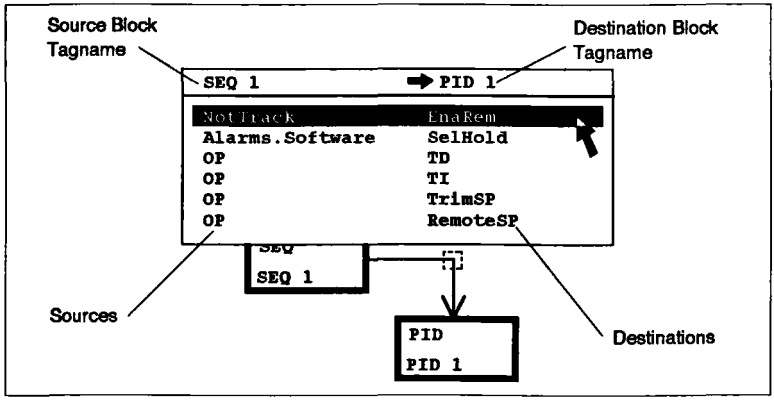


Figure 9.3 *Example Connections Menu*

■ **Multiple Block Edits.** With the **??** softkey selected, point at the worksheet background — i.e. without highlighting any objects — and press <Enter>. A movable dotted box appears with the cursor at its top left corner. Locate this corner at the top left of the required area and press

<Enter> to fix it. The cursor jumps to the bottom right of the box. Expand the box to enclose the area, then press <Enter> to fix it; the enclosed objects highlight with dotted lines. (Before fixing its size, pressing CANCEL returns the cursor to the top left corner.) A pop-up menu now appears with the options *Database* and *Block Name*. 'Database' lets you assign all the selected blocks to one database, and 'Block Name' lets you rename all the blocks — both in a single operation.

Database. Select this option to see a menu of databases — <new>, <local>, and any already-declared database names. If you select <local> or an existing database, all the highlighted blocks are automatically assigned to your selection. Selecting <new> displays an alphanumeric input window. Type in and enter the new database name. A numeric input window then appears for input of the databases's hexadecimal node number. All the blocks are then assigned to the new database.

NOTE. If a *compound* is included in the highlight, all blocks within the compound are assigned. A *header block* cannot be assigned to a remote database.

Block Name. Selecting this option displays an alphanumeric input window for entering the required edit pattern. The pattern must be a legal block name, combined with # signs and/or ? marks. The multiple edit operation replaces each '#' with a *digit*, to create a set of unique block names for the selected blocks. Only up to three '#'s are effective, since a database cannot contain more than 1000 blocks; extra '#'s are set to zero. Note that the replaced digits will automatically increment, but only if this is necessary to create a series of unique names. Replaced digits adopt the lowest possible numerical value (from 0 to 9) needed to create a set of unique names.

Each '?' is replaced with the *character* at the corresponding position in the current name, or by an underscore ('_') if no character exists there. Names in quotes are unquoted before '?' is applied.

To show you how this works, Table 9.2 gives some examples of legal edit patterns and their results when applied to the following set of block names: `CON1, CON2, CON3`.

Pattern	Result on CON1, CON2, CON3	Comments
`BLK_#`	`BLK_0, BLK_1, BLK_2`	Digits must increment
`??????12`	`CON1__12, CON2__12, CON3__12`	Last two '?'s become underscores
`A#??`	`A0N1, A0N2, A0N3`	Digits need not increment

Table 9.2 *Multiple block name edits — examples*

If all legal names created by the pattern are used up — either because they are already in the database or because not enough names result from the pattern — then T1000 will prompt you for another pattern. This continues until all the selected blocks have been properly named, or until you abort the multiple edit operation (by pressing CANCEL).

The MENU key. The name-patterns alphanumeric window includes a MENU key. Selecting MENU presents you with a list of ready-made re-naming patterns. Choose one of these to copy it to the edit window, where you can modify it if required.

NOTES. Renaming an entire database may take several seconds.
All blocks within a *compound* are renamed, but not the compound itself.

WIRE Softkey. Used to draw interconnecting 'wire' symbols between function blocks to define the signal flow through the control strategy.

- **Selecting the Source.** Press WIRE (F4), then point the cursor at the source block and press ENTER. A list of available output mnemonics appears (e.g. **SP**, **OP**, **SL**, **Alarms**, etc.). (If the source is a *compound* a list of the blocks inside appears instead; scroll to a block and press ENTER to see its outputs.) Scroll to an output and select it by pressing ENTER. (If the output is 'multi-point', e.g. **Alarms**, its individual outputs then appear. Select and ENTER the required one.)

- **Selecting the Destination.** Move the cursor directly to the destination block; a straight line 'stretches' between the blocks. With the cursor on the destination block, press ENTER; a list of available inputs appears. Note that if no valid connection is possible the WIRE operation aborts. (If the destination is a *compound* a list of the blocks inside appears instead; select and ENTER a block to see its inputs.) Scroll to an input and select it with ENTER.

- **Drawing the Wire.** If this is the only link between the blocks the direct connection line disappears. Trace a wire path backwards from destination to source. Moving the cursor generates horizontal and vertical straight lines. Press ENTER for a 90° bend in the wire. Finally, press ENTER on the source block to establish the link. The arrow-head shows the signal flow direction.

  If a link already exists between the blocks, the wiring is completed as soon as the destination input is selected. The new connection adds to the 'bus', which always appears as a single wire.

NOTE. If the newly-drawn wire forms a *closed loop* between blocks, one of the wires in the loop will appear with a dotted arrowhead enclosed in a small dotted circle. See next section.

- **Closed Loops — Loopbreak.** If when connecting up the blocks you draw a wire that forms a closed loop, you will see that one of the wires in the loop acquires a small dotted circle around its arrowhead, and the arrowhead also appears dotted.

  Blocks in the database are updated at runtime in an automatically-determined order, designed to ensure that the block producing data at the source of a connection is updated before the block that receives this data. When a loop is formed, this rule cannot apply. One of the blocks in the loop — the first one to be updated at each scan — must use data from the preceding update scan of the user task, i.e. data that is one scan old. The connection going into this initially-updated block is the one that appears dotted, to alert you to the situation. Note that if you add a wire that forms more than one loop, the corresponding number of dotted circles will appear at once.

  Often, you will be happy with the block execution order T1000 determines for a closed loop. But if the block shown with a dotted-circle input is not the one you want updated first, you can 'break' the loop at another point — i.e. re-define its 'beginning' — by setting the *LoopBrk* (Loopbreak) attribute of the required input wire.

  Loopbreak status. 'Query' the wire and locate the mouse cursor anywhere on the connections menu border. The top title banner highlights. Then, press the left mouse button or <Enter> to pop up a window showing the status of the *LoopBrk* field — **No** or **Yes**. Press <Enter> to toggle between the two. With **Yes** selected when the connections menu is quit, the wire is redrawn with a small *undotted* circle around its arrowhead to indicate 'loopbreak' status, and the dotted circle (if present) disappears.

  The undotted circle indicates to the target instrument that this block input is permitted to use data that is one scan old, and the block update ordering will be calculated accordingly.

  Note that an undotted circle *does not force* the data to be delayed, it just tells the block execution-order algorithm where you prefer it to break the loop. You can if you wish mark more than one wire in a loop with loopbreak status, or mark wires that do not at present contribute to loops.

EDIT Softkey. Used to alter the layout of the control strategy blocks and wiring. Some EDIT functions work on an *individual* object or on a group of objects within a worksheet *area*. Press EDIT (F5) to display a menu of edit options: MOVE, SIZE, COPY, CMPD, DEL, and CLS. Select and ENTER an option. The menu clears, and the options operate as follows.

- **MOVE.**

  Moving a single block —
  Point the cursor at the block, which highlights with a dotted line. Press ENTER to 'pick it up', move the cursor to the new position, then press ENTER to fix the block. Wiring 'stretches' as needed to maintain connections.

  Moving blocks/wires within an area —
  Point at a space between the objects and press ENTER. A box appears with the cursor at its top left corner. Locate this corner at the top left of the required area and press ENTER to fix it. The cursor jumps to the bottom right of the box. Expand the box to enclose the area, then press ENTER to fix it; the objects for moving highlight with dotted lines. (Before fixing its size, pressing CANCEL returns the cursor to the top left corner.) Now locate the cursor at the new position and press ENTER to move the area there. Wiring 'stretches' as needed.

  Adding an angle to a Wire —
  Point at a segment of the wire where the extra angle is to be; it highlights as a dashed line. Press ENTER to 'pick up' the new angle, then move it where required. (Pressing CANCEL aborts.) Finally, press ENTER to fix the new angle in position.

  Moving an angle or wire-end —
  Point at the angle or wire-end; it highlights with a small box. Press ENTER to 'pick up' the angle or end, move it to the new position, then press ENTER to fix it.

- **SIZE.** Alters the size/shape of *compound* blocks. Point at the block and press ENTER; the cursor jumps to its top left corner. (For objects that are not re-sizeable the cursor disappears and SIZE behaves as MOVE.) Move this corner where required — a dotted outline goes with it — and press ENTER to fix it. The cursor now jumps to the bottom right corner of the outline. Drag to the required size/shape and press ENTER to complete.

- **COPY.** Replicates a single block, compound, or all blocks/compounds and wiring in an area. Parameter values are also replicated, except for tagnames which default to "NoName". Wiring outside the block/compound or area is not replicated.

  Copying a single block —
  Point the cursor at the block, which highlights with a dotted line. Press ENTER to 'pick up' an outline copy of the block, move it to a new location, then press ENTER to fix the copy.

Copying blocks/wires within an area —
Point at a space between the objects and press ENTER. A box appears with the cursor at its top left corner. Locate this corner at the top left of the required area and press ENTER to fix it. The cursor jumps to the bottom right of the box. Expand the box to enclose the area, then press ENTER to fix it; the objects for copying highlight with dotted lines. (Before fixing its size pressing CANCEL returns the cursor to the top left corner.) Now move the box to a new position and press ENTER to copy the area there.

Note that highlighted objects/areas can be repeatedly replicated by pointing to new locations and pressing ENTER.

- **CMPD.** CMPD (Compound) combines the blocks in a selected worksheet area into a single 'compound block', with a dotted line border to distinguish it from regular blocks. Control strategy action is unaffected. Blocks and wiring inside the compound are concealed in the normal worksheet view.

  Selecting CMPD and pressing ENTER displays a box with the cursor at its top left corner. Locate this corner at the top left of the required area and press ENTER to fix it. The cursor jumps to the bottom right of the box. Expand the box to enclose the area, then press ENTER to form the compound. Items which will be included are highlighted and the message **'Are you sure?'** displayed. Press ENTER to confirm. (Before fixing its size pressing CANCEL returns the cursor to the top left corner.)

- **DEL.** DEL (Delete) deletes function blocks, compounds, wiring and wire-angles. It works on *individual* objects and on objects within worksheet *areas*.

  Deleting a single block or compound —
  Point the cursor at the object, which highlights with a dotted line. Press ENTER. The message **'Are you sure? Type ENTER or CANCEL'** appears in the message bar. Press ENTER to delete the object and any connections to it, or press CANCEL to abort the delete operation.

  Deleting blocks/wires within an area —
  Point at a space between the objects and press ENTER. A box appears with the cursor at its top left corner. Locate this corner at the top left of the required area and press ENTER to fix it. The cursor jumps to the bottom right of the box. Expand the box to enclose the area, then press ENTER to fix it; the objects for deleting appear as dotted outlines. (Before fixing its size, pressing CANCEL returns the cursor to the top left corner.) The message **'Are you sure? Type ENTER or CANCEL'** appears in the message bar. Press ENTER to delete the area and any connections to it, or press CANCEL to abort the delete operation.

Deleting a single wire —
Point at any straight segment (not angle) in the wire/bus; it highlights as a dashed line. Press ENTER to see a connection menu listing the source(s) and destination(s) of the wire, or wires in the bus. Highlight the wire to be deleted and press ENTER. The flashing message **'Are you sure? Press ENTER or CANCEL'** appears. Press ENTER to delete the wire, or CANCEL to exit the delete operation and return to the connection menu. The deleted wire is removed from the menu and another wire for deletion can be selected. If there are no more wires between the blocks the menu disappears.

NOTE. Connections into the data-logging channels of a HIST block are not visible on the worksheet as 'wires' and cannot be deleted using DEL. To delete (or edit) these connections, query the relevant *Chan n* parameter in the HIST block's Specification Menu to see a menu of two items — Change, and Clear. Select **Change** to display a keyboard for editing the existing point; select **Clear** to disconnect the channel.

Deleting a wire-angle —
Point at the angle — it highlights with a small box — then press ENTER to delete it. The wire/bus is redrawn minus the deleted angle.

- **CLS.** CLS (Clear Screen) clears all function blocks and connections from the entire worksheet.

  Selecting CLS and pressing ENTER redisplays the control strategy in dotted outline form, and the message **'Are you sure? Type ENTER or CANCEL'** appears in the message bar. Press ENTER to clear the worksheet or CANCEL to abort the CLS operation.

FILE Softkey. Saves control strategies to, and loads them from, the T1000 memory areas and DTU cards. FILE also prints hardcopy strategy listings and layouts, and amends block structure diagram (*.GRF*) files that do not match their corresponding control database (*.DBF*) files. This mismatch can happen, for example, if a strategy is edited and then only one of the edited DBF/GRF file-pair is copied to an area storing the older versions. Press FILE (F6) to display a menu of filing options: LOAD, SAVE, PRNT, and FIX. Select and ENTER an one; the menu clears and the procedure is as follows for each option.

- **LOAD.** A menu appears listing the filenames of control strategies stored in all memory areas of the T1000, including any cards inserted in the front-panel DTUs. Scroll to a filename and press ENTER. The selected strategy is copied from storage and displayed on the worksheet.

NOTE. If the selected database (.DBF) file does not for any reason match its corresponding block structure layout (.GRF) file, T1000 flashes the error message **'DBF/GRF file mismatch - use FIX'**. Press ENTER to clear the message, and then use FIX as explained below.

CAUTION! **Text Items.** T1000 tolerates, but does not support, text items created in the T500 LINtools package. Databases containing text items can be run without problem. But if you load a database containing text items into the control configurator, **T1000 warns you and discards them. On saving the database, the text will be lost.**

- **SAVE.** Selecting and ENTERing SAVE makes T1000 check that all blocks in the strategy have been given tagnames. (If not, T1000 displays **'ERROR Unnamed blocks'**. Press CANCEL to clear.) Provided all blocks have tagnames, pressing ENTER displays an alphanumeric keyboard entitled **Enter filename to save**. For a new strategy the keyboard window is empty; otherwise the previously used filename appears. Type in, or edit, the filename. To save the strategy to RAM, type in just the root filename (e.g. **CONTROL**) or prefix with M:. Otherwise, prefix the name with E:, A:, or B: (e.g. **A:CONTROL**) to direct the save to the corresponding memory area — EEPROM, DTU drive A or B, respectively. Highlight the keyboard window and press ENTER. The save executes and the control configuration worksheet is returned to.

- **PRNT.** Ensure that the printer is attached and on-line, then move the cursor to the desired object and press ENTER. With the cursor on an individual block, the block Specification Menu will be printed. Inside a compound, the compound contents and block Specification Menus will be printed. At the top level worksheet, pressing ENTER on a blank area of the screen prints the whole strategy including the connections and block Specification Menus. Holding down the CANCEL key during printing halts the printout.

- **FIX.** FIX amends a loaded .GRF file (block and wiring graphics) so that it completely matches the loaded .DBF file (database) of the same root filename. Note that the .DBF file is not amended, only the .GRF file. Select FIX to start the process. Error messages such as **'Unused GRF connection - deleted'** appear for each block or wire symbol deleted or added by FIX as it works its way through the file. Press ENTER to clear each message and allow FIX to continue until all inconsistencies have been removed, when the amended layout is displayed. Blocks added by FIX appear at the top of the worksheet and may need moving to more logical positions. Added wiring, too, may need editing to clarify the layout.

NOTE. Remember to save the 'FIXed' strategy, or the changes will be lost!

FIND Softkey. Locates the cursor on a function block selected by tagname. Press FIND (F7) to see a list of all block tagnames on the worksheet, including those nested within compounds. (For a *zoomed* compound, only blocks nested within it appear.) Point at one and press ENTER. The menu disappears and the display window auto-scrolls to bring the chosen block (or the compound containing it) into view, highlighted by the cursor.

Alternatively, instead of selecting a tagname from the menu, you can press FIND a second time to display a keyboard. Type in and ENTER the tagname to be located.

QUIT/OUT Softkey. This dual-purpose softkey is used for quitting the control configuration worksheet, and de-zooming a compound.

Quitting the worksheet —
Press QUIT; the flashing message **'Are you sure? Press ENTER or CANCEL'** appears. Press ENTER to quit the worksheet and return to the power-up screen, or CANCEL to abort the quit operation. Ensure that the strategy has been saved before performing this operation.

De-zooming a compound —
The softkey appears as OUT whenever you zoom a compound. Press OUT to de-zoom the compound and return either to the normal worksheet view, or (for nested compounds) to the next higher level zoomed compound.

Chapter 10

T1000 GRAPHIC CONFIGURATION INTERFACE: REFERENCE

Graphic Configuration Worksheet

The Graphic Configuration Interface (not available in the 'DISP' option T1000) is implemented as an on-screen 'worksheet' where the mimics (*pages* and *windows*) that will appear when the associated control strategy is run are configured. To access the *graphic configuration worksheet*, press the CFIG softkey in the power-up display to see the options CONTROL, MIMIC, and ('SEQU' option only) SEQUENCE. Highlight MIMIC and press ENTER. A menu appears listing the filenames of all control strategies stored in the T1000's memory areas, including any inserted 'smart cards'. (Filename prefixes indicate storage area: E means EEPROM, M means RAM, and A and B are the top and bottom card drives, respectively.) Note that you cannot access the worksheet unless a control strategy already exists.

Select the strategy to be linked to the new mimic and press ENTER. The list disappears leaving the blank graphic configuration worksheet ready for use (see Figure 10.1).

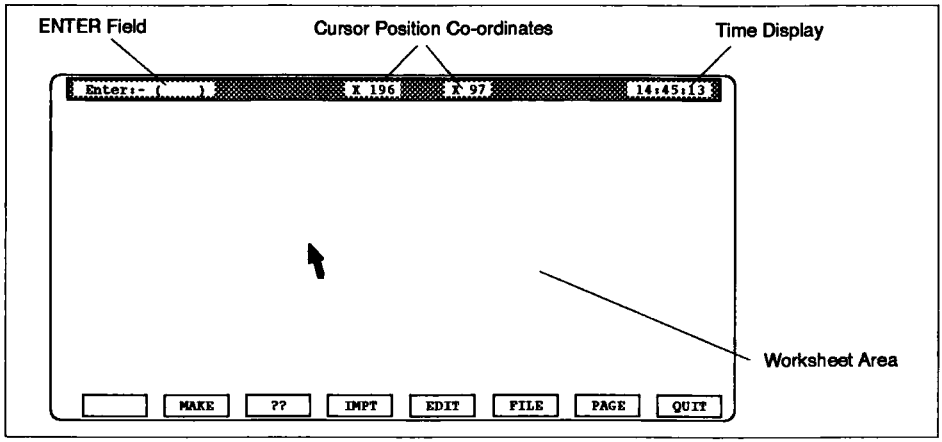


Figure 10.1 *T1000 Graphic Configuration Worksheet (Mimics)*

Enter Field. Shows the last (currently) selected *softkey* operation in the square brackets, e.g. **Enter:— [MAKE]**, or the currently active *menu option*, e.g. **Enter:— [DEL]**, or **Making : POLYLINE**. Pressing the ENTER keypad actions the current selection, without having to reselect it.

Cursor Position Co-ordinates. X and Y are in pixels relative to the worksheet's top left corner.

Time Display. The current time in *hours: minutes: seconds*. Set via the UTIL softkey, or a T1000 function block.

Worksheet Area. Where graphic objects are placed, manipulated, and linked to the control strategy. The graphic worksheet is 512 pixels wide by 224 high and fills exactly one screen.

When first accessed the worksheet is empty, ready for configuring a new graphics page or window. Existing pages/windows can be loaded to the worksheet (for modification) from memory via the FILE softkey, or imported from other control strategies via the IMPT softkey and linked to the current strategy.

Graphic Configuration Softkeys

Some of these softkeys access menus of options, and the MAKE softkey options contain sets of 'drawing tools' for designing the control strategy graphics. Table 10.1 summarises the softkeys and their uses.

Softkey	Option	Tool	Purpose	Page
MAKE	DRAW	POLYLINE	Free format lines and polygonal figures	10.4
		CIRCLE	Circles and ellipses	10.4
	TEXT	TEXT	Text strings	10.4
		READOUT	Readout/operator entry of dynamic variables	10.4
		CONDTEXT	HI/LO digital switched text with display options	10.4
		MESSAGE	8-level prioritised message field	10.5
		MENUITEM	Readout field with 8-item pop-up assignment menu	10.5
		STEP.X	Two-state message field linked to activity of a sequence step	10.6
		STEP.T	Readout field of sequence step elapsed activity time	10.7
	FASCIAS	CONTROL	Standard controller fascia	10.7
		ANMAN_ST	Auto-manual loading station fascia	10.8
		DGMAN_ST	Digital loading station fascia	10.9
		TREND	Graphical trends display window	10.10

continued...

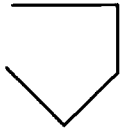
continued...

Softkey	Option	Tool	Purpose	Page
	DISPLAY	BAR	Vertical/horizontal bargraphs with choice of shading	10.11
		DIG_ITEM	Single digital item with tag and HI/LO messages	10.12
		DIGGROUP	Compound block of 8 digital items	10.13
		PAGECHNG	Page-change icon linked to digital Flashes when HI	10.13
		WINDOW	Window or 'mini-page', overlaid on whole-screen display	10.13
	ICON	ICON	Symbol builder and editor. Symbols can be page-change icons	10.14
		CONDICON	Two-state digital ICON	10.17
??(QUERY)	—	—	Displays and updates data on any graphic object on the screen	10.18
IMPT	—	—	Imports graphics from other strategies	10.18
EDIT	MOVE	—	Moves graphic objects	10.18
	SIZE	—	Resizes graphic objects	10.18
	COPY	—	Replicates graphic objects	10.18
	CMPD	—	Groups graphic objects into compounds	10.19
	DEL	—	Erases graphic objects	10.19
	CLS	—	Clears entire worksheet or active window and contents	10.19
FILE	LOAD	—	Loads specified graphics page from memory to the worksheet	10.19
	SAVE	—	Saves active graphics page to memory	10.19
	PRNT	—	Screen dumps worksheet to printer	10.19
PAGE	—	—	Names active page and specifies a follow-on page	10.19
QUIT	—	—	Returns to the power-up display	10.20

Table 10.1 *T1000 Graphics Configuration Softkeys (Mimics)*

MAKE Softkey

Press MAKE (F2) to access T1000's five groups of *graphics configuration tools* — DRAW, TEXT, FASCIAS, DISPLAY, and ICON — summarised in Table 10.1. Scroll to one of the options and press ENTER for a menu of the 'tools' within, then select and ENTER one. The 'Enter field' displays **Making : (tool name)**. Many of the graphic objects can be made 'dynamic' by linking them to the control strategy via the **??** (Query) softkey. To 'query' an object, point at it with the cursor and press ENTER; press CANCEL to exit the query function. Each tool is now described, together with use of the ?? softkey where applicable.



POLYLINE. Draws straight lines, and open or closed polygonal shapes. Point at the start position and press ENTER to fix it. Point where the first angle is to be. A straight line stretches between the startpoint and current cursor position. Press ENTER to fix the angle location. Continue generating the polyline in this way. Finally, press ENTER to fix the last point then CANCEL to finish the polyline.

CIRCLE. Draws complete circles and ellipses defined by a box 'envelope'. Press ENTER to fix the top left of the box. Drag the bottom right corner to define the envelope of the circle/ellipse and press ENTER to complete. (Press CANCEL before completion to reposition and reshape.) To paste replicas of the ellipse on the worksheet, move the box and press ENTER.

TEXT

TEXT. Creates non-interactive alphanumeric fields defined by a box 'envelope'. Press ENTER to fix the top left of the box. Drag the bottom right corner to define the envelope of the field and press ENTER to complete. The field height determines character size, and field length determines how many characters it can display (20 max.). The field is filled initially with dummy 'X' symbols. To configure the TEXT field press QUERY, point at the field and press ENTER to display an alphanumeric keyboard for inputting/editing text.

23.Ø45

READOUT. Creates a dynamic alphanumeric field. Position and size as for a TEXT field. To configure, query the READOUT field to display a pop-up menu with two entry fields:

- **Point.** ENTER to display an alphanumeric keyboard for inputting/editing a control strategy block tagname. (Pressing MENU lists available tagnames — ENTER the one containing the point to be linked). Input the tagname and a list of points appears; select and ENTER one. It appears in the Point field in compound format (e.g. **SEQ1.Mode**). If the 'point' contains 'sub-points' (e.g. **Alarms**), then a further sub-menu appears from which a point is selected (e.g. **SEQ1.Alarms.Software**).

- **Entry.** ENTER to display a submenu of four fields — **User A** to **User D** — each set to a default value of **No**. Clicking on a User field toggles it between **Yes** and **No**; i.e. between enabling and disabling (respectively) that operator's modification of the point value during runtime. Refer to Chapter 11, in the *Security Utility* section, for further details on 'Users'.

HIGH

CONDTEXT. Creates a dynamic alphanumeric field displaying either of two alternative text messages (optionally flashing), selected by a digital signal in the control strategy. Position and size as for a TEXT field. To configure, query the CONDTEXT field to display a pop-up menu with seven fields:

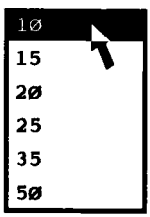
- **Point.** Enter block name/field name as for READOUT.
- **High & Low.** Access alphanumeric keyboards for entering the messages (up to eight characters) that will appear when the digital point is high and low, respectively.
- **Flash.** ENTER to toggle between **Yes** and **No**, i.e. to flash the text or not, respectively. Each state has its own independent Flash field.
- **Border.** ENTER to toggle between **Yes** (line border) and **No** (borderless).
- **Entry.** *This field works in the same way as the corresponding field in the READOUT graphic, described on page 10.4.*

FILLING

MESSAGE. Creates a dynamic field with up to eight messages which can each be selected with digital inputs. Only the highest priority active message is displayed at any time. Position and size as for TEXT field. To configure, query the MESSAGE field to display a pop-up menu with 9 fields:

- **Level 0 to Level 7.** ENTER to pop up a menu for each message level:
  Point. Enter the block name/field name as for READOUT. Note that a blank (i.e. unconnected) Point field behaves as a TRUE digital input.
  Text. Enter up to 24 alphanumeric characters as the message. Note that an empty Text field will be displayed as a *blank* message if activated.
  Flash. ENTER to toggle between flashing and not flashing.
- **Border.** ENTER to toggle between border and no border around message.

At runtime, the Text field with highest priority (Level 0 = highest, Level 7 = lowest) and a TRUE Point field is the one displayed. All 8 inputs FALSE displays a blank message.



MENUITEM. Creates a dynamic textual/numeric readout field, ENTERable at runtime to display a pop-up options menu of pre-configured values assignable to the linked point. The database point can be of any type; the menu values are all configured as text and automatically converted to the appropriate format when assigned at runtime. Note that the readout value is the actual value of the linked point, not necessarily the value entered via the menu.

Position and size MENUITEM as for a TEXT field. The precision of the readout depends on the size you make the outline, as indicated by the dummy 'X's.

To configure, query the MENUITEM to display a pop-up menu with 10 entry fields:

- **Point.** Enter block name/field name as for READOUT.
- **Value_0 to Value_7.** Access an alphanumeric keyboard for entering the values (up to eight characters) that will appear in the pop-up options menu when the MENUITEM is entered at runtime.

NOTE. Any character strings starting with **T** or **F** can be used as valid values for assigning to **TRUE/FALSE** fields, respectively (e.g. **TALLY** for TRUE). Also, any number of unambiguous initial mode name characters can be assigned to a mode field in place of the full name (e.g. **REMO** for Remote, **A** for Auto, **MA** for Manual, **F_A** for Forced Auto, etc.).

- **Border.** ENTER to toggle between **Yes** (line border around the MENUITEM field) and **No** (borderless).

ACTIVE

STEP.X. Creates a dynamic read-only field that displays one of two text messages, depending on the activity (TRUE/FALSE) of a *step* in a Sequential Function Chart (SFC).

Position and size STEP.X as for a TEXT field (except that dummy 'X' symbols do not appear). The number of message characters visible at runtime depends on the size you make the outline. To configure, query the graphic to display a pop-up menu with 7 entry fields:

- **Block.** Enter the tagname of the SFC_CON block running the sequence containing the monitored step. (At runtime, highlighting the STEP.X graphic and pressing the ENGR softkey accesses the SFC_CON block Specification Menu.) Note that the SFC_CON block must be *local*.
- **Step.** Enter the step name.
- **High & Low.** Enter the text messages (up to 8 characters) for the High (TRUE = active) and Low (FALSE = inactive) states of the step, respectively.
- **Flash.** ENTER to toggle between **Yes** and **No**, i.e. to flash the text or not, respectively. Each state has its own independent Flash field.
- **Border.** ENTER to toggle between **Yes** (line border around the STEP.X field) and **No** (borderless).

34.9s **STEP.T.** Creates a dynamic readout field that displays the elapsed activity time (read-only) of a *step* in a Sequential Function Chart (SFC). The readout is expressed with a maximum of two consecutive time units — from days (**d**), hours (**h**), minutes (**m**), and seconds (**s**) — as dictated by the magnitude of the time value, with the least significant unit expressed to one decimal place. E.g. `12.3s`, `8m44.2s`, `22h27.5m`, `1d12.8h`, etc.

Position and size STEP.T as for a TEXT field. The number of characters visible in the time readout depends on the size you make the outline, as indicated by the dummy 'X's. Eight characters are needed for a full display; too few truncates the readout without rounding. To configure, query the graphic to display a pop-up menu with 3 entry fields:

- **Block.** Enter the tagname of the SFC_CON block running the sequence containing the monitored step. (At runtime, highlighting the STEP.T graphic and pressing the ENGR softkey accesses the SFC_CON block Specification Menu.) Note that the SFC_CON block must be *local*.
- **Step.** Enter the step name.
- **Border.** ENTER to toggle between **Yes** (line border around the STEP.T field) and **No** (borderless).

CONTROL. Creates a standard controller faceplate symbol (Figure 10.2).

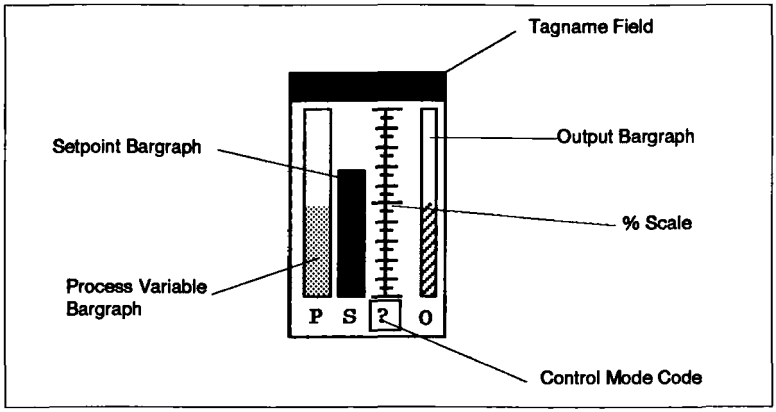


Figure 10.2 *Controller Faceplate Symbol*

The faceplate has vertical percentage bargraphs indicating the Process Variable (P), Setpoint (S), and Output (O) of the linked control block. Control Mode is

shown by the letter in the small box below the % graduations: A = AUTO, ! = Forced Manual, P = Forced Auto ('Primed'), M = MANUAL, C = REMOTE/ RATIO ('Cascade'). High and Low Absolute PV alarm levels are marked on the 'P' bargraph by horizontal dashes, and Setpoint High and Low Limits are similarly marked on the 'S' bargraph.

Position the dotted faceplate outline on the worksheet and press ENTER to paste down the complete symbol, with default mode letter '?'. Query the faceplate to access a pop-up menu of six fields:

- **Point.** ENTER the PID (or 6360, 6366) block name and field as for READOUT. (MENU lists the control blocks in the strategy. Select and ENTER the one to be linked).

- **Tag.** Accesses an alphanumeric keyboard for entering a tagname (up to eight characters) to appear at the top of the configured faceplate. (Default is the tagname of the linked control block.)

- **Rem, Auto, Man, Sp.** ENTER each of these 'pushbutton' fields to display a submenu of four fields — **User A** to **User D** — each set to a default value of **No**. Clicking on a User field toggles it between **Yes** and **No**; i.e. between enabling and disabling (respectively) that operator's modification of the corresponding faceplate pushbutton during runtime. Refer to Chapter 11, in the *Security Utility* section, for further details on 'Users'.

ANMAN_ST. Creates an Analogue Manual Station block faceplate symbol (see Figure 10.3).

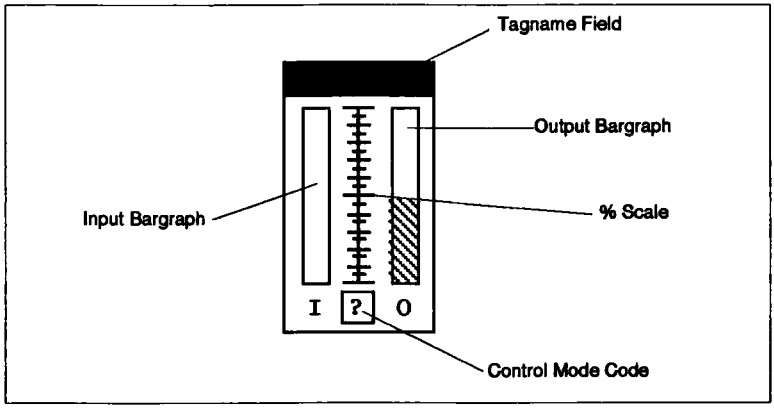


Figure 10.3 *ANMS Block Faceplate Symbol*

The faceplate has vertical percentage bargraphs indicating the Input (I), and Output (O) of the linked ANMS block. Control Mode is shown by the letter in the small box below the % graduations: A = AUTO, M = MANUAL, T = TRACK.

Position the dotted faceplate outline on the worksheet and press ENTER to paste down the complete symbol, with default mode letter '?'. Query the faceplate to access a pop-up menu of three fields:

- **Point.** ENTER the ANMS block name in the same way as for the PID block name in the control faceplate.

- **Tag.** Accesses an alphanumeric keyboard for entering a tagname (up to eight characters) to appear at the top of the configured faceplate. (Default is the tagname of the linked control block.)

- **Entry.** *This field works in the same way as the corresponding field in the READOUT graphic, described on page 10.4.*

DGMAN_ST. Creates a Digital Manual Station block faceplate symbol (see Figure 10.4) displaying the states of the linked DGMS block's Input (I) and Output (O) with user-defined messages. It also shows the Mode of the block: A = AUTO, M = MANUAL.

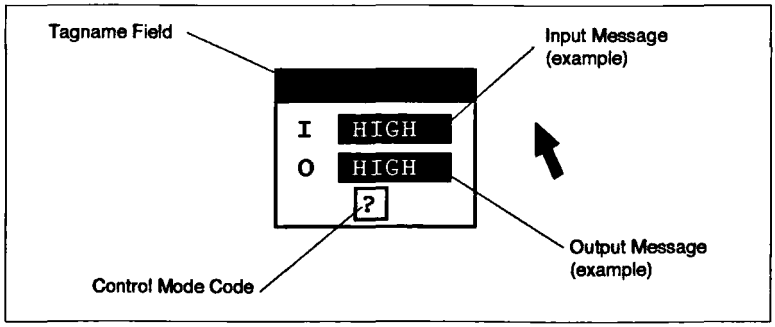


Figure 10.4 *DGMS Block Faceplate Symbol*

Position the DGMAN_ST Faceplate in the same way as for CONTROL, and query it to access a pop-up menu of five fields:

- **Point.** ENTER the DGMS block name in the same way as for the PID block name in the control faceplate.

- **Tag.** (As for ANMAN_ST faceplate.)
- **High.** Accesses an alphanumeric keyboard for entering the input or output High state message (four characters max.), displayed in reverse video.
- **Low.** Accesses an alphanumeric keyboard for entering the input or output Low state message (four characters max.).
- **Entry.** *This field works in the same way as the corresponding field in the READOUT graphic, described on page 10.4.* Note that in runtime only the output is switchable (between High and Low).

TREND. Creates a small window for runtime trending of up to three preselected analogue or digital variables. Figure 10.5 shows an example.

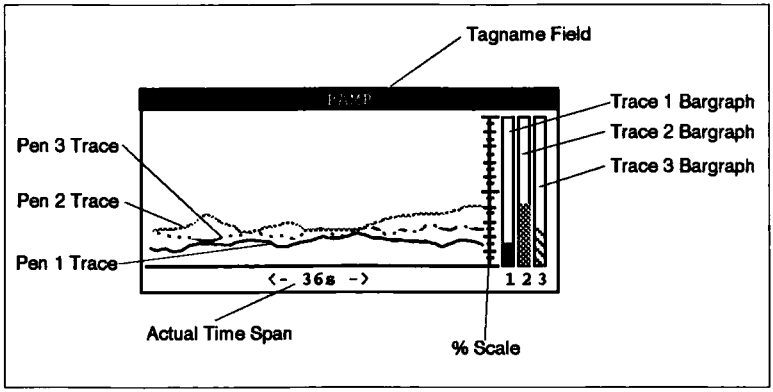


Figure 10.5 *Example Mini-Trend Window*

The plots have distinct line textures, and are also plotted as bargraphs with matching textures and pen-numbers. Vertical scaling is automatic, based on the HR and LR of the selected variables. For digitals, each pen occupies its own band matched by a short bar instead of the full-height analogue bargraph. The bar fills for the 'high' state and empties for the 'low' state.

To place a TREND window, position the top-left of the dotted outline box and press ENTER. Then expand the box to define the window size and press ENTER to complete. The minimum window size is 50 pixels wide by 75 pixels high (2 × 3 cm approx.); the maximum is 280 pixels wide by 224 pixels high (10.5 × 8.5 cm approx.). To link and configure the window, query it to access a pop-up menu of eight fields:

- **Tag.** (As for ANMAN_ST faceplate except default is blank).

- **Pen 1, Pen 2, Pen 3.** Define the variables to be plotted by each pen. ENTER the blockname (as for READOUT). MENU lists available block names. Select one to list its trendable points, then select a point. The block tagname and point are shown in compound format in the Pen field (e.g. **SEQ1.OP**).

- **Span A, Span B, Span C.** Define the three trend timespans selectable at runtime. Eight timespans exist in total, with maximum values of 1, 10, and 30 minutes, and 1, 2, 4, 8, and 24 hours. T1000 proportionally reduces these timespans for trend window widths less than the maximum. ENTER a Span field for a menu of values, then select and ENTER one; the adjusted value appears in brackets.

- **Default.** Specifies the runtime default trend window timespan, A, B, or C.

BAR. Creates a rectangular box (Figure 10.6) that can be linked to an analogue or digital point to act as a dynamic bargraph. Position the top-left of the dotted outline box and press ENTER. Then expand the box to define the BAR shape and press ENTER to complete. To configure and link the BAR, query it to access a menu of five fields:

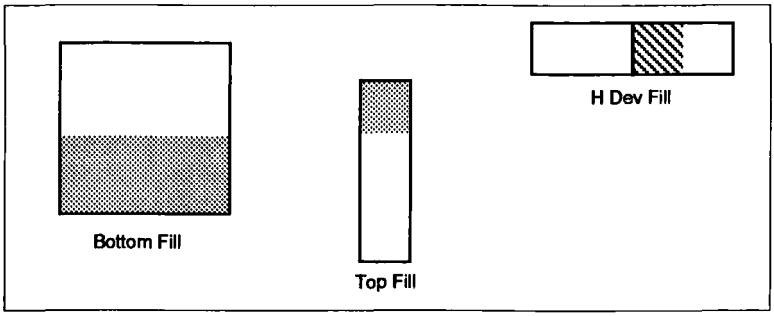


Figure 10.6 *Examples of BAR Graphics*

- **Point.** ENTER the block tagname (as for READOUT). MENU lists blocks with points capable of linking to the bar (depending on whether it is digital or analogue, as configured by the *Fill* field). Select and ENTER one to list all its linkable points, then select and ENTER a point. (Select a *sub-point* if a further list appears.) Its name appears in the Point field in compound format (e.g. **FURN_AIR.PV**).

NOTE. To link to a *digital* point you must first select **Digital** in the **Fill** field, as described below. The default Fill option is **Bottom**, which prevents the linking of digitals.

- **Hatch.** Specifies the bar's fill texture. ENTER and select one from the list: Block (solid), Stipple (default medium tone), Weave (light tone), Polka (dark tone), Lshade, and Rshade (cross-hatchings).

- **Fill.** Defines how the bar shading responds to variations in the linked point. The nine options are:

  Top, Bottom, Left, Right. The bar fills from the top, bottom, left, or right, respectively, as the linked variable increases from zero, and is empty for values ≤0.

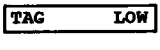
  H Dev, V Dev. The bar fills from a centre zero line in a rightward horizontal (H Dev) or an upward vertical (V Dev) direction as the linked value increases from zero. Negative values are plotted in the opposite directions.

  Digital. Defines a digital bar with two runtime states: empty for a 'low' point and full (with the selected Hatch) for a 'high' point.

  Full, Empty. Define the bar as a static (unlinked) graphic object, completely *full* of the selected Hatch, or *empty*, respectively.

- **Border.** ENTER to toggle between **Yes** (line border) and **No** (borderless).

- **Entry.** *This field works in the same way as the corresponding field in the READOUT graphic, described on page 10.4.*



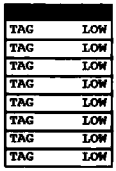
DIG_ITEM. Creates a fixed-size text field reporting the state of a digital point. Position the dotted box outline and press ENTER. The legend 'TAG LOW' appears in the box. Query it to access a menu of five fields:

- **Point.** ENTER the block tagname (as for READOUT). MENU lists available block names. Select and ENTER one to list all its digital points, then select and ENTER a point. (Select a *sub-point* if a further list appears.) Its name appears in the Point field in compound format (e.g. **FURN_AIR.OUT**).

- **Tag.** Accesses an alphanumeric keyboard to enter a tagname (8 characters max.) appearing on the left of the configured DIG_ITEM. The default is 'TAG'.

- **High & Low.** Accesses alphanumeric keyboards to enter the legends (4 characters max.) displayed when the digital point is 'high' and 'low', respectively. The 'high' legend appears in reverse video.

- **Entry.** *This field works in the same way as the corresponding field in the READOUT graphic, described on page 10.4.*



DIGGROUP. Creates a group of eight DIG_ITEMs in a single compound graphic, placed in the same way as a single DIG_ITEM. Query and configure each item in the group individually as for single DIG_ITEMs. To assign a compound name to the DIGGROUP, query its border or title bar to access an alphanumeric keyboard, then enter a name (8 characters max.).

PAGECHNG. Creates an icon that flashes if a linked digital goes high. ENTERing it at any time displays a preselected graphics page/window. Position the dotted box outline and press ENTER. Query it to access a menu of three fields:

- **Title.** Accesses an alphanumeric keyboard to enter the PAGECHNG icon label (4 characters max.).

- **Number.** ENTER to access a decimal keyboard for inputting the number of the page/window to appear when the icon is ENTERed at runtime (dummy default is '0'). The field shows the page title (or default) followed by the page number in square brackets. If the page number is not assigned to a page, no title appears.

- **Point.** ENTER the block tagname (as for READOUT). MENU lists available block names. Select and ENTER one to display its digital points, then select and ENTER the point to be linked to the PAGECHNG icon. (Select a *sub-point* if a further list appears.)

WINDOW. Creates a variable-sized 'mini-page' inset on the current runtime full page; several windows can be open at runtime. A window is not a graphics object but can *contain* graphics objects. See Figure 10.7

Position the top-left of the dotted outline box and press ENTER. Then expand the box to define the window shape and press ENTER to complete. At runtime the window will appear at the current cursor position, not where it was created during graphics configuration.

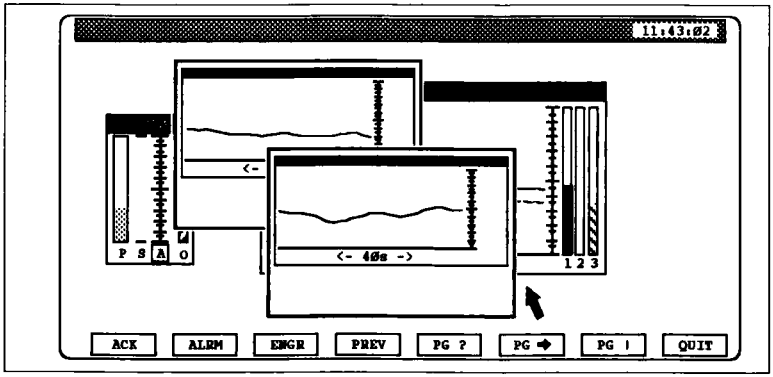


Figure 10.7 *Example of Windows at Runtime*

A newly created/loaded/imported window becomes the 'active' window. Subsequent drawing appears inside it, and with the cursor inside the window the X, Y co-ordinates are relative to it, not the whole screen. SAVE or PAGE operate on the active window. To clear the active window from the screen use CLS (Clear Screen) in the EDIT menu. With other windows on-screen, the one previously created/loaded/imported becomes the new active window.

ICON. Creates user-designed fixed-size static graphic symbols that can be named and filed to build up a library. ENTERing an icon at runtime displays a linked graphics page/window (if configured).

Select and ENTER the ICON option for a list of stored icon filenames, headed by **<new>**. To place a stored icon on the worksheet, select and ENTER it, then position its dotted outline and press ENTER. To create a new icon select and ENTER **<new>** to see the *icon-build menu* with three fields: (With no stored icons the icon-build menu appears immediately.)

- **Icon.** Shows the (actual-size) default icon symbol: a square with corner angles and central dot. ENTERing this field accesses the *symbol-build screen*, described below.

- **Background.** ENTERing this field toggles it between **Black** and **Clear** to make the icon opaque or transparent, respectively, to objects it overlaps.

- **Page.** ENTER to access a decimal keyboard for inputting the number of the page/window to appear when the icon is ENTERed at runtime (dummy default is '0'). The field shows the page title (or default) followed by the page number in square brackets. If the page number is not assigned to a page, no title appears.

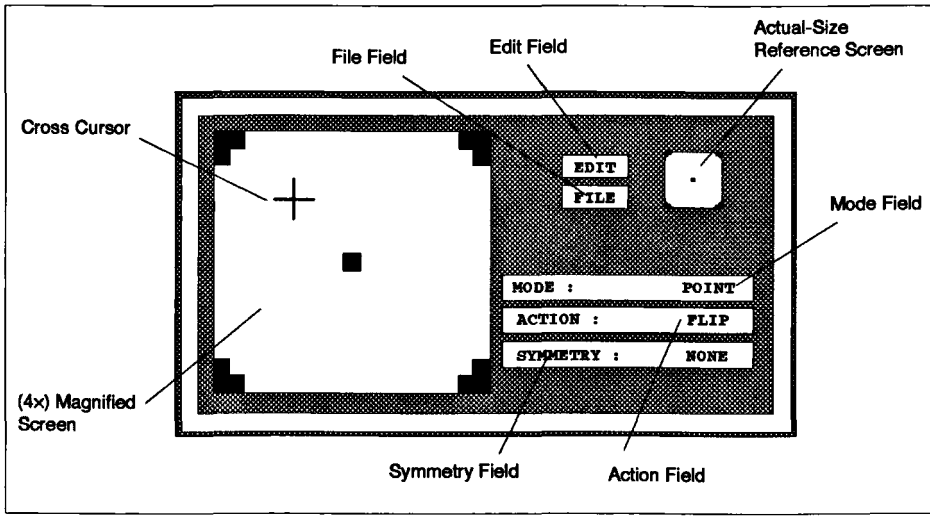


Figure 10.8 *Symbol-Build Screen*

The Symbol-Build Screen. The area where the icon symbol is drawn. See Figure 10.8.

Magnified Screen. 32 × 32-pixel drawing area (4 × actual-size). Point the cross-cursor at a pixel and press ENTER to modify it, or draw a line. X-Y co-ordinates are relative to the top left of the magnified screen. The cursor becomes the regular arrow when moved off the screen and the X-Y display blanks out. Use the arrow to highlight and ENTER the five fields to the right of the drawing area (drawing action and edit).

Actual-Size Reference Screen. Shows true appearance of the icon.

MODE. Selects drawing tool. ENTERing cycles around three options:

POINT. Press ENTER to draw a single pixel dot. To draw a continuous line of dots 'freehand', hold down ENTER and move the cursor.

LINE. Draws straight lines. Point at the line start and press ENTER. Point at the line end — a guide-line appears — then press ENTER to complete.

MOVE. Moves the drawing around in the screen. Point at where the 'moving handle' is to be, hold down ENTER and move the cursor. The whole drawing moves with it.

ACTION. Defines action of selected drawing tool. ENTERing cycles around three options:

FLIP. Press ENTER to reverse the state of a dot (black to white, or white to black).

SET. Press ENTER to switch or leave the pixel 'on' (i.e. white).

RESET. Press ENTER to switch or leave the pixel 'off' (i.e. black).

SYMMETRY. Defines simultaneous generation of extra dots related by mirror symmetry to the ones being cursor-drawn. ENTERing cycles around four options:

NONE. No extra dots generated.

VERT. Extra dots appear reflected in a central horizontal mirror line.

HORZ. Extra dots appear reflected in a central vertical mirror line.

BOTH. Extra dots appear reflected in a pair of perpendicular mirror lines. (VERT and HORZ options applied together.)

EDIT. Edits the icon in the magnified screen. ENTER displays a menu of six edit tools. Select and ENTER one:

ROTATE + & *ROTATE –*. Centrally rotates the icon 90° clockwise (+) or anticlockwise (–).

MIRROR | & *MIRROR –*. Replaces the screen contents with its reflection across a central vertical (|) or horizontal (–) mirror line.

INVERT. 'Flips' the state of every pixel.

CLEAR. Clears the magnified screen.

FILE. Retrieves (loads) and stores (saves) icons. ENTER to see a menu of two options, then select and ENTER one:

LOAD. Lists all stored icon filenames. Select and ENTER one to copy it to the symbol-build screen.

SAVE. Displays an alphanumeric keyboard. Key in and ENTER a name (8 characters max. including any prefix) under which the icon is stored (in RAM, unless prefixed with a memory-area code, e.g. **A:SYMBOL**).

Quitting the ICON Symbol-Build Screen. To quit, press CANCEL to see a menu of two items:

- **Use This.** Places the current icon onto the graphics worksheet. Press ENTER for the icon-build menu, reconfigure the fields if required, then press CANCEL to close the menu. Position and paste down the dotted icon outline (press ENTER) as often as required.

- **No Change.** Quits ICON without placing the current symbol. Press ENTER for the icon-build menu, then press CANCEL twice more.

Editing an ICON in Position on the Worksheet — Using QUERY. Query the icon to display its *icon-build menu*. Edits of the *Backgrd* or *Page* fields are actioned by pressing ENTER. To modify the icon design, access the *symbol-build screen*, edit the icon, then press CANCEL to see the *Use This/ NoChange* menu. ENTER for the icon-build menu, then press CANCEL. The edited icon exactly replaces the original on the worksheet. (ENTER *No-Change* to return to the icon-build menu and ignore any edits.)

CONDICON. Creates a dynamic 'high/low' symbol-pair that switches state with a linked point in the strategy, and can be ENTERED for manual switching (if configured). Each symbol in the CONDICON pair can be individually saved/loaded/edited as an ICON. Position the dotted square outline and press ENTER to see the default 'low state' symbol — a downward arrow. Query it to access a menu of seven fields.

- **Point.** ENTER the block tagname (as for READOUT). MENU lists available block names. Select and ENTER one to display its digital points, then select and ENTER the point to be linked to the CONDICON. (Select a *sub-point* if a further list appears.)

- **High & Low.** Show the default 'high' and 'low' state symbols: upward and downward arrows, respectively. ENTER to access the *symbol-build screen* for editing/loading/saving exactly as for ICON. Stored ICONs and stored *individual* symbols in a CONDICON pair are completely equivalent.

- **Flash.** ENTER to toggle between **Yes** and **No**, i.e. to flash the symbol or not, respectively. Each state has its own independent Flash field.

- **Copy.** Copies a symbol from one state to the other. Highlight to see the message **Menu . . .**, then ENTER to display a menu of two items. ENTER **Hi -> Lo** to copy the 'high' symbol to the 'low' symbol; ENTER **Lo -> Hi** to copy the 'low' symbol to the 'high' symbol.

- **Entry.** *This field works in the same way as the corresponding field in the READOUT graphic, described on page 10.4.*

?? (QUERY) Softkey

Press ?? (F3) to access data for review/update on any displayed graphic object. Use of QUERY with the MAKE library of objects is covered in the previous sections. Another use of QUERY is to simulate state- and variable-changes in graphic objects linked to points in the control strategy. Press QUERY repeatedly to 'animate' incrementally every linked (dynamic) object on the screen. (Pressing ENTER with QUERY selected and no object highlighted has the same effect.)

IMPT Softkey

Imports a graphics page/window from another strategy into the current one. Press IMPT (F4) for a list of stored control strategy filenames. Select and ENTER one to see a menu of its page/window titles, then select and ENTER a title for importing. An imported page *displaces* the current one (T1000 sends a warning message), but a window only *overlays* it. The imported page/window is displayed, and becomes the active worksheet.

EDIT Softkey

Used to edit the graphics worksheet, by moving, resizing, copying, compounding, and deleting selected objects. Press EDIT (F5) to see a menu of six options. These work in very similar ways to the *Control Configuration* EDIT options described earlier.

- **MOVE.** Moves a single object or those within a defined area, and adds or moves angles in POLYLINEs. (Used as described in Chapter 9 on page 9.6.) MOVE does not work on a window itself, only on objects within.

- **SIZE.** Resizes certain objects, namely: CIRCLE, TEXT, READOUT, MESSAGE, CONDTEXT, TREND, BAR, WINDOW, and also *compounds*. (Used as described in Chapter 9 on page 9.7.) For other objects SIZE acts as MOVE.

- **COPY.** Replicates objects singly or within a defined area. (Used as described in Chapter 9 on page 9.7.) COPY does not work on a window itself, only on objects within. Copied objects have all the attributes of the original, including tagnames and links with the control strategy.

- **CMPD.** Combines objects in a defined area of the active worksheet/window into a single bordered *graphic compound* that can be titled, resized (border only), moved, copied, and deleted as a single object — though objects within can still be individually accessed. Make compounds as described in Chapter 9 on page 9.8. To *title* a compound, query its border or title bar to access an alphanumeric keyboard. Input the name (8 characters max.) to appear in the title bar.

- **DEL.** Deletes objects singly or within a defined area, and removes angles from POLYLINEs. (Used as described in Chapter 9 on page 9.8.) DEL (Delete) does not work on a window itself, only on objects within.

- **CLS.** CLS (Clear Screen) clears all objects from the active worksheet, or clears the currently active *window* and contents. (Used as described in Chapter 9 on page 9.9.)

FILE Softkey

Saves (and numbers) graphics pages/windows to, and loads them from, T1000 memory areas; prints graphics hardcopy. Press FILE (F6) for a menu of options, then select and ENTER one. The menu clears and the procedure is as follows for each option.

- **LOAD.** Lists graphics page/window titles associated with the current control strategy. Select and ENTER one. A warning appears if the load would overwrite the current worksheet — press ENTER to proceed, CANCEL to abort. The loaded page/window becomes the currently active one.

- **SAVE.** Displays a decimal *page number* keyboard, with the existing page number (if any) in the highlighted window. To overwrite an existing page leave the number as it is. To create a new page (and keep an existing one), type a new page number. Press ENTER to save the numbered page.

- **PRNT.** Prints out the current graphics page. See Chapter 9, page 9.10.

PAGE Softkey

Assigns an optional *Title* to a graphics page/window, and an optional *Next Page* to a graphics page. Press PAGE (F7) to see a menu of one field (*Title*) for a window, or two fields (*Title, Next*) for a page. Press CANCEL to clear the PAGE menu.

- **Title.** Displays the current page/window title (if any). ENTER for an alphanumeric keyboard to input a title (8 characters max.). The default is '**Page_*n***', (***n*** = page number).

- **Next.** Displays the current page 'next page' title (if assigned) and number (in square brackets) which specify the runtime page/window accessed from this page by the **PG —>** softkey. ENTER for a decimal numeric keyboard to input a page number (0 to 99). If no 'next page' is specified, the default is the next highest (cyclic) page number.

QUIT Softkey

Quits the worksheet and returns to the power-up screen (as described in Chapter 9 on page 9.13, under *Quitting the worksheet.*)

Chapter 11

T1000 UTILITIES INTERFACE: REFERENCE

The T1000 Utilities Interface comprises five utilities — FILES, SETUP, NEW TIME, REMOTE, and SECURITY — accessed via the power-up screen's **UTIL** softkey. Press **UTIL** to see the menu of utilities, then select and ENTER one to access its display. Table 11.1 summarises the utilities.

Utility	Purpose	Page
FILES	File information/handling: location, size, copy, delete, device format	11.1
SETUP	Assigns T1000 LIN node address; specifies control database to be run at cold-start; specifies devices to be scanned for graphics page/window files	11.5
NEW TIME	Sets system time and date	11.6
REMOTE	Downloads strategies to remote devices on the LIN. Starts/stops remote running	11.6
SECURITY	Configures softkey security setups	11.6

Table 11.1 *T1000 Utilities*

FILES Utility

Figure 11.1 shows a typical FILES screen. Note that a limited version of the FILES screen is accessible at runtime — the Runtime Trend Filing Page — via the PG? softkey.

FILES Screen. The entire FILES window is larger than the T1000 screen — scroll the display to the left to see the last three columns, and upwards to see complete lists, by moving the cursor to the edge of the display. (The rightmost **'R:'**, **'T:'**, and **'??:?:'** columns are not shown in Figure 11.1.)

Enter Field. Shows the last (currently) selected *softkey* operation in the square brackets, e.g. **Enter:— [DEL]**, or the currently active *filing operation*, e.g. **Copying A:***filename*. Pressing ENTER actions the current selection without having to reselect it.

Tagged Field. Shows the total memory (bytes) occupied by all *tagged* files, i.e. those with filenames marked by an arrow. Filing operations generally act

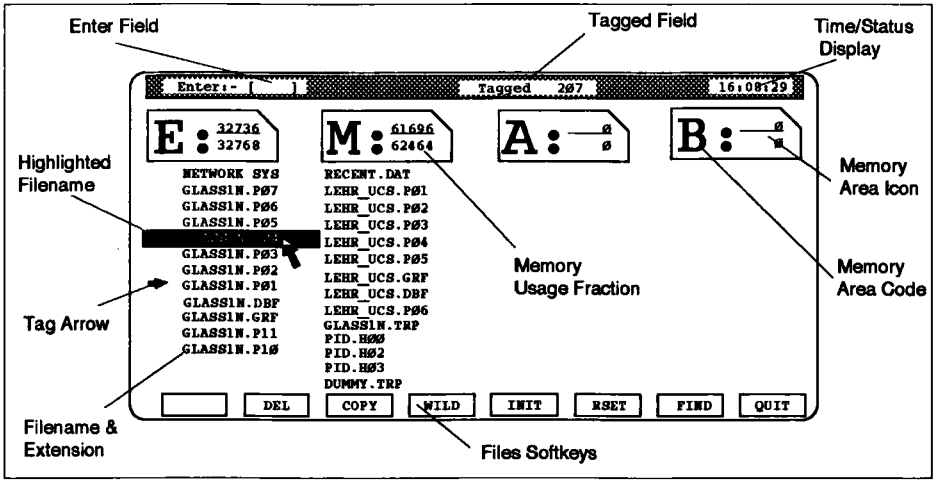


Figure 11.1 *T1000 FILES Screen*

on tagged files. To tag a file select the DEL, COPY, or WILD softkey, highlight the filename (in reverse video), and press ENTER. To un-tag, highlight and press ENTER again. Tag or un-tag more files in the same way. To tag groups of files with the same root filename, or all files in a memory area, use the WILD softkey (see later section).

Time/Status Display. Normally shows the current (system) time in *hours: minutes: seconds*, set via the NEW TIME utility, or a T1000 function block. During filing operations a flashing **WORKING** message replaces the time display, and during DTU drive access **DTU A+** (top drive) or **DTU B+** (bottom drive) appears.

Memory Area Icon. 'Punched card' symbol at the head of each column of filenames. Contains the *Memory Area Code*, and the *Memory Usage Fraction*.

Memory Area Code. Letter indicating the T1000 *memory area* storing the files listed in each screen column. Codes are **E:** (EEPROM), **M:** (RAM), **A:** (DTU top drive), **B:** (DTU bottom drive), **R:** (ROM), **T:** (Template ROM), and **??::?:** (remote files, see under INIT softkey below). All areas are read/write except read-only R: and T:.

Memory Usage Fraction. Shows current memory usage above the fraction bar and total capacity below the bar (bytes), for each memory area. A *zero* denominator means the memory area is not installed or accessible (e.g. DTU card not inserted).

Root	Extn.	File Type
Control strategy name	.GRF	Control strategy block structure diagram and wiring
Control strategy name	.DBF	Database for parameters, connections, etc.
Control strategy name	.Pnn	Graphics page or window. (nn = decimal page number, 1-99)
Control strategy name	.TRP	Full-page trend window configuration
Control strategy name	.TRD	Recent trend channel configuration
Control strategy name	.RUN	T100 coldstart filename
Icon name	.DLO	Graphic symbol (user-created ICON)
HIST block Filename	.Hnn	Historic trend data logged by HIST block. (nn = base-36 no.)
System filenames	.SYS	System (e.g. CONFIG)
System filenames	.LIB	Library of system routines in ROM area (e.g. MATHPROC)
ERRORS	.MSG	Error messages, in ROM area
Sequence name	.SGX	Sequence graphics (SFCs)
Sequence name	.SDB	Sequence database
Action filename	.STO	Compiled structured text (to be run from an ACTION block)
Record Filename	.RCD	Record file (0 - 49 records each)

Table 11.2 *T1000 File Types*

Filename & Extension. Files have 8-character (max.) *root filenames* with 3-character *extensions*, e.g. **FILENAME.DBF**. Files belonging to a particular control strategy have its name as a common user-assigned root filename; T1000 adds extensions for each file type. Special files are used by the operating system. Table 11.2 summarises file types and uses.

FILES Softkeys

Table11.3 summarises the FILES softkeys and their uses.

Softkey	Purpose
DEL	Deletes tagged files
COPY	Copies tagged files
WILD	Selects groups of files with the same root filename
INIT	Clears and initialises a local memory area. Accesses a memory area in a remote T1000
RSET	Updates files screen
FIND	Lists filenames by specified characters
QUIT	Returns to the power-up display

Table 11.3 *FILES Softkeys*

DEL Softkey. Deletes tagged files from a single memory area (not ROM). Press DEL (F2), tag the filenames, highlight the memory area icon, then press ENTER. Respond to the **'Are you sure?'** message by pressing ENTER to proceed or CANCEL to abort.

NOTE. Do not delete **CONFIG.SYS** from **E:**

COPY Softkey. Copies files from one or more memory areas to a single area (except ROM). Press COPY (F3), tag the filenames, highlight the target memory area icon, then press ENTER. The files are untagged after copying.

NOTE. Trying to copy a file to the read-only **T:** memory area causes it to become unmounted, which in turn causes any database operation to report a *Bad Template* error.

WILD Softkey. Tags/untags a *group* of files in a memory area with the same root filename, or *all* its files. To tag a group press WILD (F4), highlight any member file, then press ENTER. Repeat to add more groups from any memory area. To un-tag a group highlight a member file and press ENTER. To tag an entire memory area press WILD, highlight the area icon and press ENTER. Repeat either procedure to add more groups or memory areas. To un-tag an area highlight its icon and press ENTER.

INIT Softkey. Formats a local memory area, i.e. clears and re-initialises it (not ROM). Press INIT (F5), highlight the area icon and press ENTER. Respond to the **'Are you sure?'** message by pressing ENTER to proceed or CANCEL to abort.

INIT also allows access to a memory area in a remote T1000, with the same filing facilities as for local files (except for the ability to format the remote file). To access a remote device, press INIT, highlight the **??::?:** memory area icon, and press ENTER to see an on-screen keyboard. Type in the hex node address and device code (i.e. E, M, A, B, T, or R), then press ENTER to display the files (if the remote device is present). Note that the remote T1000 must be displaying its main menu screen — with RUN/CFIG/UTIL softkeys — for access via INIT.

NOTE. With Issue 3/1 software, do not attempt to access the **??::?:** memory area while the T1000 is acting as a *file server*, i.e. is responding to a remote instrument's request for file transfer operations. Also, do not use **??::?:** while the target remote instrument is acting as a *client*, i.e. initiating file transfer operations in a remote instrument. This is because Issue 3/1 software does not allow an instrument to be both server and client at the same time. (From Issue 3/2 the software does not have this limitation.)

RSET Softkey. Forces a files screen update (e.g. to access a newly inserted DTU).

FIND Softkey. Allows the file lists to be restricted to certain named files. Enter the name on the pop-up keyboard. Use ? as a wild character.

QUIT Softkey. Quits the Utilities interface and returns to the power-up screen (as described in Chapter 9, on page 9.13 under *Quitting the worksheet*).

SETUP Utility

SETUP accesses a menu of seven fields: *Node No*, *Segment*, *Startup*, *Del stup*, *Mimic*, *HistMax*, and *HistSize*:

Node No. Shows the currently assigned node address of the T1000 on the Local Instrument Network (LIN). Every device on the LIN must have a unique node address in the range 01 to FE. To assign an address, highlight and ENTER the field to see a hexadecimal keyboard for address input. Do not use 00 or FF. Press CANCEL to return to the power-up screen.

NOTE. You must reset the instrument after changing its node number.

Segment. Identifies the particular LIN to which the T1000 is, or will be, attached. To assign a segment number, highlight and ENTER the field to see a hexadecimal keyboard for input, in the range 1 to F. Press CANCEL to return to the power-up screen.

Startup. Specifies the control strategy to run automatically when the T1000 'cold starts', i.e. restarts after losing power for a time ≥ **ColdStrt** (a T1000 block parameter). Select and ENTER Startup for a list of stored control strategies. Highlight one and press ENTER to assign it as the 'cold start strategy' and write its filename to the (EEPROM) CONFIG.SYS file.

Del stup. Allows deletion of the Startup control strategy filename from the CONFIG.SYS file. Select and ENTER Del stup, then respond to the 'Are you sure?' message by pressing ENTER to remove the Startup file, or CANCEL to abort the operation.

Mimic. Specifies what devices are to be searched for matching graphics files (.Pnn extension) when a control database is run, in addition to the device storing the control database (.DBF extension) itself. ENTER the Mimic field to display a keyboard. Type in and ENTER letters corresponding to the devices in the search order required, e.g. **MABE**. Note that the more devices listed the longer the search time.

HistMax. Specifies the maximum number of historic trend data files allowed to co-exist. When this limit is reached, the oldest file is automatically deleted before a new file is created. The default is 16 files, and the permitted range is 2 to 64.

HistSize. Specifies the file size for history files. The default is 4096 bytes, and the permitted range is 1024 to 65535.

NEW TIME Utility

NEW TIME sets the local T1000's system *calendar/clock* (used in the message bar clock, alarm reports screen, alarm log hardcopy, and the longterm & historic trending package). Select NEW TIME to see a decimal keyboard called **NEW DATE [d.m.y]**. Input a date as day number, month number, and year number (excluding century digits), separated by periods (e.g. **22.1.89**). A decimal keyboard then appears called **NEW TIME [h.m.s]**. Input a 24-hour-clock time as hours, minutes, and seconds, separated by periods (e.g. **14.5.30**). The new date/time starts (and the power-up screen returns) when the last ENTER is pressed.

REMOTE Utility

REMOTE downloads control strategies to remote devices on the Local Instrument Network (LIN), and can also remotely stop/start their running. Selecting REMOTE displays a special set of softkeys.

NODE Softkey. Specifies the remote device's LIN segment (first two digits) and node address (last two digits). Press NODE (F2) to see a hexadecimal keyboard for inputting the data, which then appears at the top of the screen. Note that if you enter just a two-digit node, without specifying a LIN segment, T1000 supplies a suitable (logical) segment number automatically.

SEND Softkey. Downloads strategies to remote devices. Press SEND (F3) to list all local control strategy files. Select and ENTER one to download it to the specified device's RAM area (and EEPROM if configured) and start running it. This operation does not download to units that have the VDU configurator in use.

STOP, GO Softkeys. Press STOP (F4) or GO (F5) to stop or start, respectively, running the strategy in the remote device's RAM area.

QUIT Softkey. Press QUIT (F8) to quit the REMOTE utility and return to the power-up screen.

SECURITY Utility — CardWatch™

CardWatch. The CardWatch T1000 Softkey Security System lets you control the degree of access different levels of personnel have to T1000's configurators, utilities, and runtime interface, via DTU cards. CardWatch operates

both locally and plant-wide. In a particular mimic, for example, runtime entry of each graphic can be restricted to a specified operator. At the same time, security coverage can be tailored to the varied requirements of different instrument groups on the LIN, and also of different LIN segments across the plant.

Security Levels. CardWatch is based on a hierarchy of six security levels, from 'View' at the bottom to 'Configure' at the top, plus a default level — 'Null' — beneath View. Each level has its own set of 'privilege' functions (softkeys) that only it, and higher levels, can use. Table 11.4 charts the softkeys accessible to each security level, with the privilege functions shaded. Generally speaking, low-level access is restricted mostly to runtime operator functions, whereas the higher-level users can access database configuration and system setup parameters.

CardWatch also permits multi-level configuration. For example, a user may have the status of 'Configure' when accessing one group of instruments, 'Files' status at a second group, 'Operate' at a third, and so on, according to his areas of responsibility and expertise. Up to eight combinations are possible in a single DTU card.

Security Setup. CardWatch works as follows. Every DTU card stores a 'security setup' configuration, specifying the security levels and access areas of the cardholder. A 'default' setup is also resident in the T1000 RAM area, to define security when there are no cards present. Security setups are configured within the SECURITY utility, and are protected from alteration by a 'PIN' security number.

Every time a 'secured' softkey is pressed, CardWatch checks the resident setup, and then the setups of any inserted DTU cards, looking for the minimum necessary security clearance to access that particular softkey, at that node address and segment number. If the required clearance is found, access is permitted. If not, CardWatch inhibits the softkey and flashes an 'Access Denied' message, stating the minimum security level needed for that softkey.

Configuring Security Setups

Accessing the Security Setup Window & Softkeys. To access the window, press the **UTIL** softkey in the power-up screen, then select SECURITY from the options menu displayed. The security setup window appears — filled with default field values as shown in Figure 11.2 — together with a set of special security setup softkeys. Note that the window accessed via SECURITY is always filled with default values.

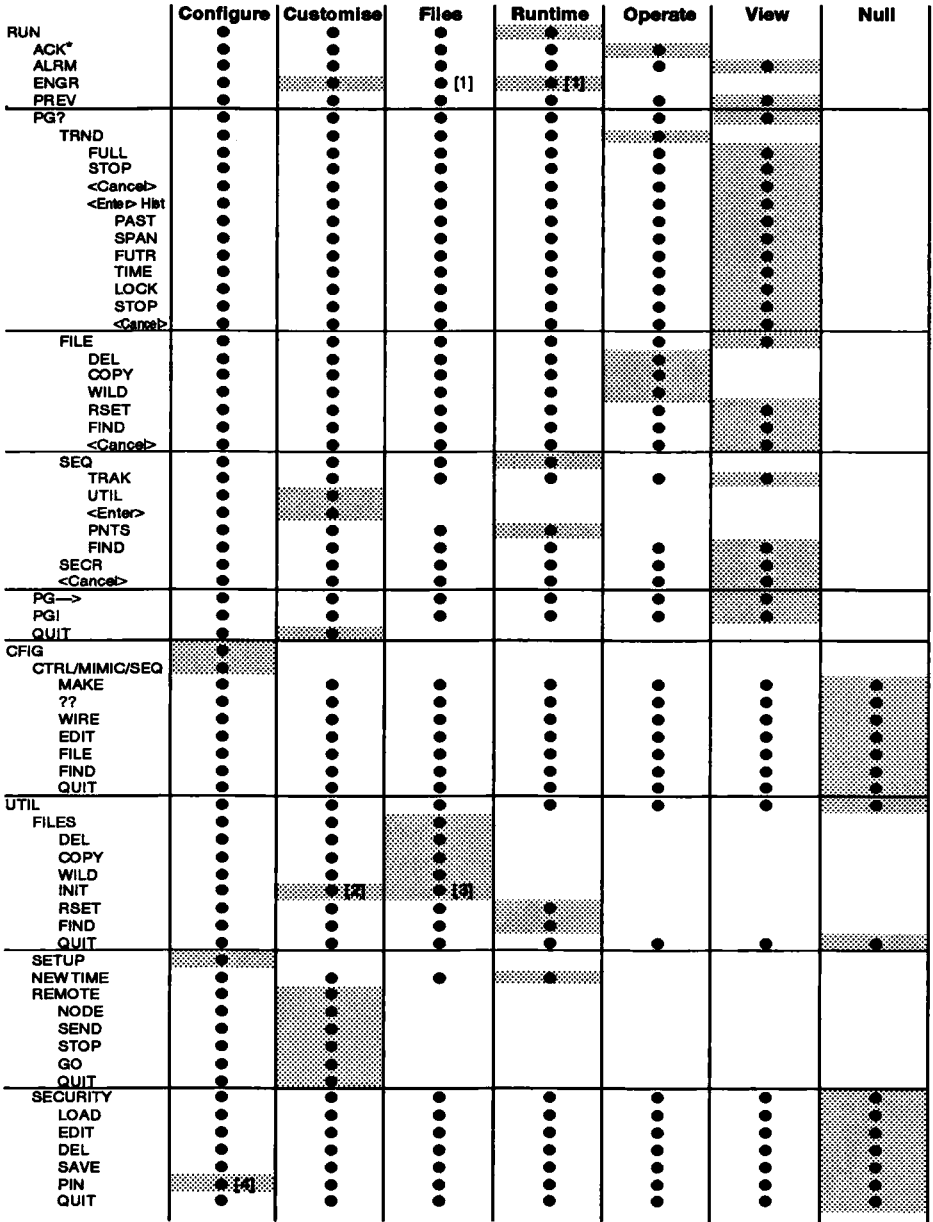


Table 11.4 *Softkey Access by Security Level*

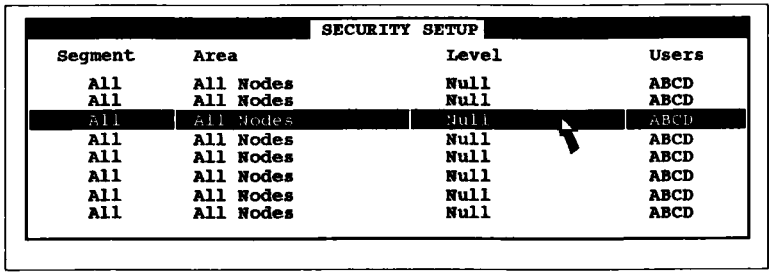


Figure 11.2 *T1000 Security Setup Window*

NOTE. All the security functions are available at the lowest 'Null' level (see Table 11.4) and so can be accessed without a DTU card.

Security Setup Window Features. The window displays eight lines of default configuration data. This allows up to eight combinations of security criteria to be configured on a single DTU card (or in the default setup in the T1000). The data is in four columns — *Segment*, *Area*, *Level*, and *Users* — which are described below in the EDIT softkey section.

Security Setup Softkeys. Table 11.5 summarises the security setup softkeys, which are fully described afterwards. The schematic in Figure 7.2 (Chapter 7) shows how the security softkeys fit into the overall T1000 softkey hierarchy.

Softkey	Function
LOAD	Screens the DTU A, B, or Resident security setup window for inspection/editing
EDIT	Allows editing of all security setup fields in the loaded window
DEL	Resets a line of security setup values to their default field values
SAVE	Stores a configured setup to the DTU A, B, or Resident security setup file
PIN	Allows the PIN to be changed
QUIT	Returns to the power-up display

Table 11.5 *T1000 Security Setup Softkeys*

LOAD Softkey

Copies a security setup to the window, for inspection and/or editing. Press LOAD to see a menu of three options, then select and ENTER one:

- **RESIDENT.** Loads the security setup resident in the T1000's CONFIG.SYS file. This setup determines softkey access levels when no DTU cards are inserted.

NOTE. If the Resident setup is absent or corrupted T1000 flashes the error message *'Invalid default security info'*. In this case a new Resident setup must be configured and saved as described below.

- **DTU A, DTU B.** Loads the security setup from the card inserted in DTU drive A or B, respectively. Security data is stored (invisibly) in a DTU's header area, and so is not erased by deleting files. Formatting the card, however, does clear the security setup.

EDIT Softkey

Allows entry into a security setup field to change its value. Highlight the field to be edited. The whole line of data highlights, but separator lines help you position the cursor in the correct column. Press ENTER to see a list of possible values, then select and ENTER one. Note that edits do not take effect until the setup is SAVED to a DTU or the T1000 Resident setup.

The options for each column are:

- **Segment.** Identifies the particular LIN referred to by this line of the security specification. The default value is **'All'**, i.e. all LINs in the plant. The 15 other possible values in the menu are segments **1** to **F** (hexadecimal). A segment number is assigned to an instrument via the T1000 SETUP utility.

- **Area.** Specifies a group of nodes on the LIN segment defined in the *Segment* field. The default is **'All'**, i.e. all nodes on the LIN. The 15 other possible node groups in the menu are **Nodes 01-1F, 20-2F, 30-3F, 40-3F, ... E0-EF**, and **F0-FE** (hexadecimal). A node number is assigned to an instrument via the T1000 SETUP utility. Node numbers 00 and FF are invalid (reserved).

- **Level.** Specifies the security level, i.e. position in the access hierarchy, for this line of the security setup. The default is **'Null'** which has the minimum security access privileges. The other possible levels are **View, Operate, Runtime, Files, Customise**, and **Configure**. Each level name broadly summarises its privilege functions, defined in detail in Table 11.4.

- **Users.** Specifies selective access to runtime entry of graphic objects. Editing a 'Users' field displays a pop-up menu of four fields — **User A, User B, User C**, and **User D** — which can be toggled between **Yes** or **No** by ENTERing their Yes/No fields. Figure 11.3 shows the Users menu.

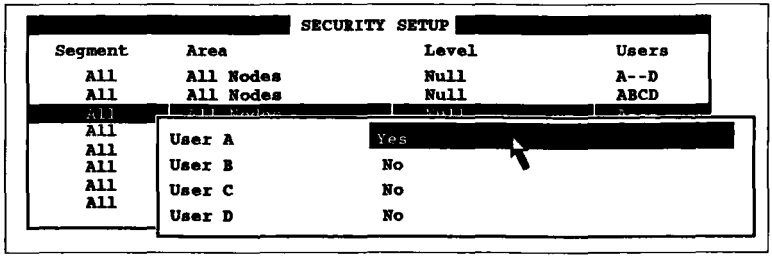


Figure 11.3 *'Users' Pop-Up Menu*

Each of the letters A to D represents a user who — when set to 'Yes' — is allowed to enter a particular graphic object at runtime, provided that the object itself has been enabled for entry by that user. (Entry enabling is done in the graphics configurator, via the graphic's *Entry* field.) 'Yes' settings show in the *Users* field as corresponding letters, and 'No' settings show as dashes (see the example in Figure 11.3).

For example, setting *User A* and *User D* to 'Yes' means that — if the other access criteria in this line of the setup are fulfilled — the user is able to enter at runtime any graphic that has been enabled for (at minimum) A and/or D entry. If an attempt is made to enter a graphic that has not been enabled for that particular user, an *'Access Denied'* message is flashed, and entry is blocked.

NOTE. A line in a security setup must always have at least one User set to 'Yes', otherwise the access via that line of the setup reverts to the 'Null' personnel level. This applies in or out of runtime.

DEL Softkey

Resets an entire line of security setup fields to their default values. Press DEL, highlight the required line (anywhere), and press ENTER to reset the line. Note that deletes do not take effect until the setup is SAVED to a DTU or the T1000 Resident setup.

SAVE Softkey

Stores the currently displayed security setup to a DTU card or to the T1000 Resident setup. Press SAVE to see a hexadecimal keyboard for entering the T1000's PIN code. Type in the 4-digit code, which is initially factory-set to '1234' but can be altered at any time via the PIN softkey (see below). Highlight the keyboard window and press ENTER to see a pop-up menu of options: RESIDENT, DTU A, and DTU B. These correspond to the options of the

LOAD softkey, described above. Select and ENTER the required device to save the security setup to its memory area. (If the DTU is absent, an appropriate error message flashes.)

PIN Softkey

Allows you to alter the PIN security code number, needed whenever you want to save a setup. The PIN is initially factory-set to '1234' but can be altered at any time as follows. Press PIN to see a hexadecimal keyboard. Unless the top security level 'Configure' is available, you are prompted to type in the 'old' (existing) 4-digit code first. Highlight it and press ENTER. Another keyboard appears in which you type and enter the *new* code; you will be asked to enter it a second time as an added security measure. The new PIN is now configured.

With 'Configure' status, you are not asked to enter the old PIN code, but can key in the new code directly.

Note that mis-keyed PINs flash up error messages, e.g. **'Invalid PIN'** or **'PINs do not match — unchanged'**, which you must CANCEL before starting again.

QUIT Softkey

Press QUIT to return to the power-up display.

Chapter 12

ERROR MESSAGES & DIAGNOSTICS

This chapter deals with T1000 error messages and diagnostics. All error conditions have an associated 4-digit number, and most have in addition a corresponding text message (stored in the ERRORS.MSG ROM file) which is displayed on the T1000 screen when the error occurs. If the error has no text message only the error number is displayed. Its meaning can be looked up in Table 12.1 below.

NOTE. Foreign language error messages may be generated for the T1000 by copying the R:ERRORS.MSG file onto a PC, translating the messages (keeping the same format), and copying the file back onto drive M: or E:.

As well as on-screen error messages, single-character *diagnostic codes* are shown by a 7-segment red LED display on T1000's back panel (see Table 12.2). These codes appear briefly during instrument power-up and indicate the correct operation of T1000 hardware/software as the power-up sequence progresses. If the sequence fails, the diagnostic code remaining on display helps locate the fault. During normal running the diagnostic display is blank. Note that for some diagnostic codes there is also an accompanying error number displayed on the T1000 screen at the same time.

LIN channel status. Two red LEDs on T1000's back panel indicate the status of the two LIN channels, A and B. Table 12.3 gives details.

Error Number Structure

Error numbers are hexadecimal 4-digit groups with the first digit always '8' or '9' (currently). Digit 2 shows the 'package' running when the error occurred.

Packages are defined as:

1 Base Directory
2 File system
3 Database system
4 Graphics system
5 Objects system
6 Trend system
7 Control Configurator
8 Runtime Configurator
9 Network Error
A Remote Database system

Digits 3 and 4 comprise a 2-digit error code indicating the nature of the error in the running package. The full list of current error numbers and their meanings is given next.

T1000 Error Numbers & Messages

In Table 12.1, items marked with an asterisk (*) also apply to the T100.

Number	Error	Comments/(Examples)
8201*	Device not mounted/compatible	(Not formatted, or corrupt)
8202*	Invalid device specified	(Z:)
8203*	Error performing I/O to device	(Write/Read protected by wrong switch settings)
8204*	Feature not implemented	
8205*	Formatting error	
8206*	Physical device not present	
8207*	Device full	
8208*	File not found	
8209*	No handles for file	Not enough memory to open file and note its state
820A*	Bad filename	
820B	Verify error	
820C	File locked	Already in use
820D	File read-only or No key fitted	
8301	Bad template	
8302	Bad block number	
8303	No free blocks	
8304	No free database memory	
8305	Not allowed by block create	
8306	In use	
8307*	Database already exists	
8308*	No spare databases	
8309*	Not enough memory	
8320*	Bad library file	(Corrupt ROM file)
8321*	Invalid template in library	
8322*	Bad server	(Corrupt file when loading)
8323*	Cannot create EDB entry	External dbase reference (when loading file)
8324	Bad file version	
8325	Bad template spec	
8326	Unable to make block remote	
8327	Invalid parent	
8328*	Corrupt data in .DBF file	
8329*	Corrupt block spec	

continued...

continued...

Number	Error	Comments/(Examples)
832A*	Corrupt block data	
832B*	Corrupt pool data	
832C*	No free resources	
832D*	Template not found	
832E*	Template resource fault	
8330*	Cannot start	Remote utility
8331*	Cannot stop	Remote utility
8332*	Empty database	
8333	Configurator in use or device busy	When remote operation attempted (T1000-T100)
8340*	.DBF file write failed	
8341	More than one .RUN file found	
8342	.RUN file not found	
834A	Connection Source is not an O/P	
834B	Multiple connection to same I/P	
834C	Connection Destination not I/P	
834D	No free connection resources	
834E	Bad conn. src/dest block/field	
834F	Invalid connection destination	
8350	Warmstart switch is disabled	
8351	No database was running	
8352	Real-time clock is not running	
8353	Root block clock is not running	
8354	Coldstart time was exceeded	
8355	Root block is invalid	
8356	Too many control loops	
8357	Coldstart switch is disabled	
8501	Out of F RAM - DO NOT save file	
8502	Out of N RAM - DO NOT save file	
8602	Bad channel number	
8603	Bad type code	
8611	Bad handle or not HIST	
8613	File exists	
8614	Exceeded global limit	
8615	Unexpected end of file	
8616	Read error	
8617	Write error	
8619	Bad filename	
861A	Bad timestamp	

continued...

continued...

Number	Error	Comments/(Examples)
8701	Unnamed block	When saving file
8702	Cannot save compounds	When compound zoomed
8703	No root block	
8704	.GRF file write failed	
8705	Compound too deep	
8706	Unused GRF block — deleted	
8707	Unused GRF connection — deleted	
8708	Missing GRF block — added	
8709	Missing GRF connection — added	
870A	Unknown DBF/GRF block mismatch	
870B	Unknown DBF/GRF connect mismatch	
870C	DBF/GRF file mismatch — use FIX	
8901	Network timeout	
8902*	Rejected by local node	
8903*	Rejected by remote mode	
8904*	Not implemented	
8905*	Not active on local node	
8906*	Not active on remote node	
8907	Transmit failure	
8908	Failed to get memory	
8909	Decode packet	
890A	Remote file system busy	
8999	Network node invalid	
8B01	Object Overload	
8B02	Text Overload	
8B03	No Matching Step Name	
8B04	No Matching Action Name	
8B05	Step already Exists	
8B06	Action already Exists	
8B07	Link already Exists	
8B08	Leave a Bigger Gap	
8B09	Bad Time Format	
8B0A	File Read Error	
8B0B	File Write Error	
8B0C	File doesn't Exist	
8B0D	File not Open	
8B0E	Create Action ?	
8B0F	No Match with string	
8B10	No More Matches	
8B11	Match found in Transition	

continued...

continued...

Number	Error	Comments/(Examples)
8B12	Match found in Action	
8B13	Changed — Are you sure ?	
8B14	Link Already Exists	
8B15	Illegal Chars in Name	
8B16	Action Did Not Compile.	
8B17	Fatal Memory Overflow - Quit Now!	
8C01	Database not Running	
8C02	No Sequence Loaded	
8C03	Sequence is being displayed	
8C04	Cannot find an SFC_DISP block	
8C05	Cannot find Source File	
8C06	Sequence Not Loaded	
8D01	Syntax Error	
8D02	Statement expected	
8D03	Assignment expected	
8D04	THEN expected	
8D05	no ELSE or END_IF	
8D06	END_IF expected	
8D07	";" expected	
8D08	Bad bracket matching	
8D09	Identifier too long	
8D0A	Bad identifier	
8D0B	Unrecognised symbol	
8D0C	Code Buffer Full	
8D0D	Expression expected	
8D0E	Can't find this name	
8D0F	"String" > 8 chars.	
8D10	End quotes expected	
9001	Invalid PIN	
9002	PINs do not match — unchanged	
9003	Invalid PIN — reset to 1234	
9004	Access denied	
9005	Invalid default security info	
9006	Invalid DTU A security info	
9007	Invalid DTU B security info	
FFFF*	*(Unspecified error)*	

Table 12.1 *T1000 Error Numbers & Messages*

Screen Display	Diagnostic Code	Condition Indicated
	0	MCPU not running
	1	MCPU running
	2	Checksummed ROM
	3	RAM and stack OK
	4	(*Reserved*)
	5	Hardware I/O initialised
	6	Graphics card accessible
0000	7	Graphics card working
0010	(*Blank*)	IOP running
0020	(*Blank*)	Serial ports checked
0030	(*Blank*)	Lineprinter set up
0040	(*Blank*)	Attention interrupt OK
0100	(*Blank*)	Xec running OK
0200	(*Blank*)	Floating point OK
0300	(*Blank*)	Wipe pad OK
0400	(*Blank*)	Filing system OK (ROM/RAM)
0500	(*Blank*)	Panel clock display OK
0600	(*Blank*)	Delay/interrupt clock OK
0700	(*Blank*)	Initialisation task ended
0700	(*Blank*)	IDBase processes Initialised
	8*	Watchdog (*at runtime*)
	9*	Unexpected h/w interrupt (*at runtime*)
	(*Blank*)	T1000 running OK

*Transient unless Watchdog disabled

Table 12.2 *T1000 Diagnostic Code Numbers*

LIN A LED	LIN B LED	LIN Status
Off	Off	Channel A working, Channel B standby, *or* Channel B working, Channel A standby
Off	Flashing	Channel A working, Channel B LRA fault
Flashing	Off	Channel B working, Channel A LRA fault
Flashing	Flashing	Token not being passed (no other instruments attached), *or* LRA fault on both channels, *or* Channel A standby, using faulty channel B (forced mode), *or* Channel B standby, using faulty channel A (forced mode)
On steady	On steady	Hardware or addressing fault

Table 12.3 *Rear-panel LIN status LEDs*

Chapter 13

SPECIFICATIONS

T1000 Database Maximum Sizes

Table 13.1 lists the absolute maximum numbers of function blocks, external databases, cached blocks, and so on, that can run in a T1000 unit.

Item	Maximum Number
Function blocks, all types	500
Function block types	64
External databases (EDBs)	31
Local blocks cached elsewhere (FEATTs)*	128
Cached blocks (TEATTs)	500
Connections	1024

* One FEATT is used for each external instrument that a given local block is cached in.

Table 13.1 *T1000 Database Maximum Sizes*

Software/Hardware Issue Compatibility

T1000 Hardware/Software Compatibility

Table 13.2 shows what software issues can be run in the available T1000 hardware (main board) issues. At the intersection of a pair of issues a tick indicates compatibility, and a cross incompatibility.

		T1000 Software Issue		
		- 2.2	2.3 - 2.5	3.1 - 5.1
T1000 Hardware Issue	1	√	√	X
	2	√	√	X
	3	√	√	X
	4	X	√	√

Table 13.2 *T1000 Hardware/Software Compatibility*

T100 Hardware/Software Compatibility

Any issue of T100 software runs in any issue of T100 hardware. However, *Sequencing* (when specified), and the *LIN redundancy algorithm*, function only with Issue 2 hardware onwards.

NOTE. In Issue 4 hardware the LIN is isolated and must be earthed separately.

T1000/T100 Communications Compatibility

Table 13.3 shows what software issues can be run together in different instruments communicating on the same LIN network. At the intersection of a pair of issues a tick indicates compatibility, and a cross incompatibility.

Software Issue	2.1	2.2	2.3	2.4	2.5	3.X
2.2	√					
2.3	X	X				
2.4	X	X	√			
2.5	X	X	√	√		
3.X	X	X	√	√	√	
5.1	X	X	X	X	X	√

Table 13.3 *T1000/T100 Communications Compatibility*

Note however that the LIN redundancy algorithm functions only when ***all*** the instruments on the network are running Issue 3.1 (or later) software.

Warranty & After-Sales Service

Eurotherm Process Automation Limited will normally repair/replace an instrument which is found to be defective within 24 months of delivery. *Full details of the Warranty are given in our Terms & Conditions, available from the Sales Office.*

Eurotherm Process Automation Limited offers a comprehensive range of services including Training, Systems Support, Field Service/Commissioning, Custom Linearisation, and Repair/Re-calibration. For further information please contact our Customer Services Division, tel. Worthing (0903) 205277.

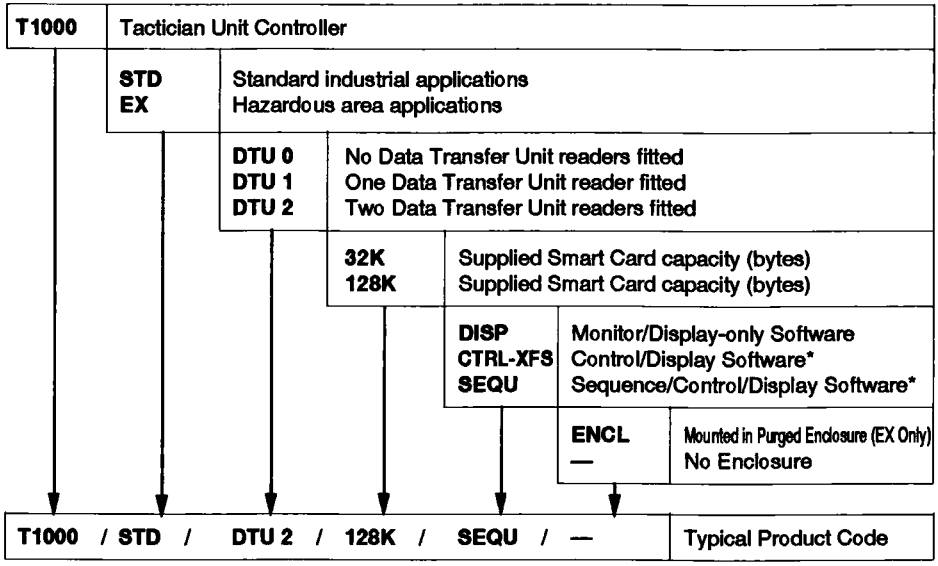
Documentation & Software Issue Definition

Issue X/Y denotes documentation that refers to an instrument with software issue number X (all releases covered), at edition Y (Y is a letter). E.g. Issue 3/D refers to software Issue 3 and manual edition D (the fourth).

Manuals start at edition A. New editions of the manual are produced to correct typographic or factual errors or omissions, or to update the manual with the latest software *release* information. The new edition letter increments to the next letter in alphabetical order.

When a new *issue* of software appears (not just a new release of the existing issue), the related documentation has the new issue number and starts at edition A again.

T1000 Order Codes



*Extended Filing System (128Kb EEPROM) fitted as standard

DTU Order Codes

Item	Code
32Kb Data Transfer Unit (DTU) 'Smart Card'	S9150/32
128Kb Data Transfer Unit (DTU) 'Smart Card'	S9150/128

GLOSSARY OF TERMS

Here is an alphabetical list of selected terms and their meanings as used in T1000 (and T100) manuals. Those new to this type of equipment or to Eurotherm Process Automation instrumentation in general may find this glossary helpful.

Active Window

Graphic Configuration: a newly created/loaded/imported window becomes the 'active window', in which the cursor acts and subsequent graphics/mimics appear.

Adaptive Gain

PID Control: Gain Scheduling. Continuous variation of the Proportional Band (XP) for optimum control at different process operating conditions.

Auto-Scroll

Automatic shifting of the Control Configuration worksheet screen contents to reveal unseen areas when the cursor is positioned at the very edges of the display.

Automatic up- or downward movement of an Options Menu items list to reveal unseen items when the cursor is positioned at the top or bottom edge, respectively, of the menu border.

Bitfield

Block Specification Menu data field in the form of an 8- or 16-digit binary number, representing up to 8 or 16 two-state parameter values.

Block

See Function block.

Block Overview

T100 Configurator: displayed list of block parameters and values, equivalent to a T1000 Specification Menu.

Block Structured

Describing a control strategy built up from interconnected pre-defined function blocks rather than from a sequence of specially written individual instructions.

Brownout

Power failure lasting long enough to trip the BrownOut alarm and cause the instrument to warm start, but not long enough to cause it to cold start.

Bump

Abrupt change in the output of a controller, which may damage valves and destabilise the controlled process.

Cached Block

An 'image' in the local database of a block running in a remote instrument on the LIN that allows communications with the remote block. In the local Control Configuration worksheet cached block icons are distinguished from local blocks by having finer borders.

Card-Key

DTU smart card used as a key to access restricted 'engineer' functions at runtime (e.g. parameter changes, escape operations).

Characterisation

(Synonymous with *Linearisation*, in T1000). Translation of an analogue input (x-values) to an output (y-values) via a 'characteristic curve' — i.e. a stored set of 16 x-y points ('breakpoints'). The characteristic curve is interpolated linearly between breakpoints.

Cold Start

Power-up after a relatively long power break (≥ColdStart parameter), with complete re-initialisation of the parameter database. If a STARTUP file exists the specified control strategy is then loaded and run automatically.

Compound

Control Configuration Worksheet: a group of function blocks and their interwiring combined for clarity into a single 'compound block'. Icons representing compounds have dotted borders and their contents are concealed in the normal worksheet view.

Conditional Icon

A graphic icon or symbol that adopts a 'high' or 'low' form according to the state of a linked digital point.

Control Configurator

Software package for designing/configuring a block-structured control strategy.

Control Mode

Mode of operation of a control block, defining how the loop responds to input signals and operator interaction. Seven control modes exist and can be selected — each with its own characteristics and priority — but only the selected one with the highest priority is active.

Control Strategy

Block structured software package which at runtime interacts with plant to control its behaviour.

Cursor

Graphic object that can be moved around the screen with the wipe pad or a mouse, to select, highlight, or 'point at' objects, or draw dots and lines. Usually in the form of a small arrow, the cursor appears as a cross or box in certain operations.

Data Transfer Unit

DTU. One of the pair of T1000 front panel sealed drives accepting 'smart cards' which allow two-way data transfer between T1000s, smart cards, and PCs (via the S9160 Interface).

Dead-Time

DTIME (Deadtime) Function Block: time delay introduced into an input measurement signal PV. Each DTIME block can apply up to four delays, specified by its *Delay1* to *Delay4* parameters.

PID Controller: time for which the output is held against a limit after a persistent error causing integral term windup has reversed. Eliminated automatically by the Integral Desaturation technique.

Debounce

Filtering applied to a digital signal to remove 'spikes', in which state changes lasting less than a specified number of samples are ignored.

De-Zoom

Longterm Trend: increase a trend's plot range (by a factor of two), so decreasing its vertical resolution, by pressing the OUT softkey.

Diagnostics

System of on-screen error numbers and messages, rear-panel diagnostic LED display codes, and T100 front-panel LEDs, providing help when a malfunction occurs.

Download

REMOTE Utility: copy a complete control strategy database to a remote device on the LIN, specified by its node address.

DTU

See Data Transfer Unit.

Dynamic Graphic

Graphic object linked to a point in the control strategy that changes appearance with changes in the point's value, and so can be used to monitor it or act as an animated element in a runtime graphics display. Most dynamic graphics can be ENTERed at runtime (if enabled) allowing the operator to alter (possibly) the value of the linked point.

Engineering Units

Floating-point general-purpose parameter units.

ENTERing

Pressing the ENTER hardkey on the T1000 front panel (or the left-hand mouse button) to input the contents of a highlighted field to a database; to access a highlighted option, pop-up options menu, function block, or graphic object for subsequent interaction; or to conclude a drawing operation.

Equal Band

COMPARE Function Block: 'tolerance band' applied symmetrically in the *Equal To* function. Two inputs are registered as 'equal' when their difference falls below the Equal Band value. (Hysteresis is also applied outside the Equal Band as the difference increases.)

Error

Control Blocks: Error (ER) = Process Variable (PV) minus Setpoint (SP).

Expand

Control & Graphic Configuration: adjust the size/shape of a compound or defined worksheet area by moving the cursor at the bottom right-hand corner of the compound or area to the required position and pressing ENTER to 'fix' it.

Faceplate Symbol

CONTROL Faceplate: standard graphic icon representing the front panel of a TCS Network 6000 controller. Can be made dynamic by linking it to a control or S6000 block in the strategy, and ENTERable at runtime to allow 'pressing' of the displayed 'pushbuttons'. (Other faceplate symbols represent dynamic Analogue and Digital Manual Stations which link to single points and are ENTERable.)

Fallback Mode

Control mode taking over from the currently active mode if all modes become deselected.

Fascia Graphic

See Faceplate Symbol.

Field Key

One of the set of keys below the T1000 screen labelled F1 to F8 which operate the corresponding softkeys displayed at the bottom of the screen.

Freeze

Longterm Trend Display: stop a trend being updated via the STOP softkey — the trace remains stationary in the trend window. Subsequent data is not lost, merely not displayed until the trend is 'unfrozen' via the GO softkey.

Arrow Cursor: immobilise the arrow cursor in the power-up screen or in a worksheet, by pressing the CANCEL key (or clicking the right-hand mouse button). This transfers wipe pad (or mouse) control to the softkeys at the foot of the screen. Pressing CANCEL again unfreezes the cursor.

Function Block

Software module, represented on the T1000 screen by a box-shaped icon, performing a specific task or group of tasks within a control strategy, e.g. PID control block. Function blocks are selected from a library resident in the instrument.

GID

Group Identifier. 3-bit number in the range 0 to 7 identifying a group of instruments on an RS422 data bus. The GID and the Unit Identifier (UID) together form the Instrument Number (INO).

GRAFCET

GRAphe de Commande Etape Transition. Functional graphical chart used to describe a logical control system, especially one involving a sequence of steps, drawn according to French Standard NF C 03-190, June 1982.

Graphic Configurator

See *Mimic Configurator.*

Graphic Object

Symbol or construction drawn on the graphics configuration worksheet, or placed there from the standard library, to form part of a runtime graphics page. Graphic objects can be static or dynamic. E.g. POLYLINE, CONDICON.

Graphical Readout

Dynamic graphic object indicating the value of a linked control strategy point. The point value may be changed at runtime by ENTERing and operating on the Graphical Readout, provided it has been enabled for runtime entry. E.g. READOUT, BAR, DIG_ITEM.

Graphics Page

One of the runtime screen displays created during graphics configuration to enable operators to monitor and if necessary interact with the controlled process via graphic objects on the page. Up to 20 pages (subject to available memory) may be created for a control strategy and menu-accessed or scrolled in a predefined sequence.

Graphics Window

A user-sized window, created during graphics configuration, that can be displayed at runtime as an additional graphics 'mini-page' overlaying part of the

current graphics page at the current cursor position. Graphics windows can contain all the graphic objects allowed for full-screen pages, and several windows can be displayed on the runtime screen together.

Group Identifier

See GID.

Hardkey

One of the keypads to the right of the T1000 screen with invariable functions. Hardkeys form the numeric keypad, ENTER and CANCEL keys used during configuration and runtime.

Header Block

One of the function blocks in the CONFIG category — T1000, T100, or T231 according to the intended local base unit — that must be placed first on the control configuration worksheet before configuring the rest of the strategy. Its icon is distinguished from other blocks by a double border. A header block specifies the intended local database name (via its tagname), cold start and brownout alarm trip times, and allows use of the system realtime clock.

High State Message

User-defined alphanumeric legend displayed by a digital dynamic graphic object at runtime when the point linked to it is 'high', i.e. at logic state 1. In some graphic objects the message can be preset to flash.

Highlight

Select a graphic object, menu item, data field, keyboard window etc., by pointing at it with the cursor. The highlighted field or object displays in reverse video or becomes outlined by dots.

Historic Trend

Plot of historic data against time displayed on the runtime T1000 screen by the Longterm Historic & Realtime Trend package. The historic data, collected in special files by HIST blocks, can originate from any strategy including the current one and can be trended together with realtime data. Trend spans and ranges can be shifted and zoomed, and spot values read off with a line cursor.

Icon

Symbol displayed on the T1000 screen representing a function block or other software entity, capable of being accessed to reveal further levels of information.

Import

Graphics Configuration: copying a complete graphics page or window from another control strategy into the database of the current one, via the IMPT

softkey. The imported page can then be used directly in the current strategy, or modified as required, saving needless redrawing.

INO

Instrument Number. 7-bit number in the range 0 to 127 identifying an instrument address on an RS422 data bus. INO bits 0-3 contain the UID, and bits 4-6 contain the GID, giving an INO decimal value of (16 × GID) + UID.

Instrument Number

See INO.

Integral Balance

Adjustment applied to the integral term of the PID control algorithm to prevent unwanted output bumps that occur after control mode changes etc.

Integral Desaturation

Adjustment applied to the integral term of the PID control algorithm when the control output exceeds a limit. It prevents integral term windup and the large PV overshoots that would result from delay (deadtime) in the output returning within limits.

Integral Term Windup

Accumulation of a large value in the PID algorithm's integral term (a function of ΣER) owing to a persistent error. This can hold the controller output at a limit for a deadtime period after the error reverses, leading to large PV overshoots. The Integral Desaturation technique automatically eliminates deadtime in the T1000 controller.

Interactive Graphic

Dynamic graphic that can be ENTERed by the operator at runtime to alter the linked point's value.

Latch

Switch a digital parameter value or bit to logic one, i.e. 'high', such that when the switching conditions are removed the parameter remains set. *See also* Set.

LIN

Local Instrument Network. A token-passing masterless network running at 1Mb allowing peer-to-peer T1000/T100 communications and file transfer.

Linearisation

See Characterisation.

Linked Graphic

See Dynamic Graphic.

Local

Communications Network: situated at the node currently being configured or under consideration. *See* Remote.

Control Block: referring to an automatic control mode where the resultant setpoint SP derives from a parameter within the control block itself (local setpoint SL). *See* Remote.

Local Block

Block running in the local instrument on the LIN. (*See* Cached Block.)

Longterm Trend

Trend displayed on the runtime T1000 screen by the Longterm Historic & Realtime Trend package — *see* Historic Trend.

Low State Message

User-defined alphanumeric legend displayed by a digital dynamic graphic object at runtime when the point linked to it is 'low', i.e. at logic state 0. In some graphic objects the message can be preset to flash.

Memory Area

One of the five areas of file storage available in T1000, represented by icons at the top of the Files Utility screen — E: (EEPROM), M: (RAM), A: (DTU top drive), B: (DTU bottom drive), and R: (ROM).

Message Bar

(Banner). Shaded narrow area along the top of the T1000 screen reserved for special messages. It contains the system clock readout, and — at relevant times — the current configuration operation, cursor co-ordinates, DTU accessed, filing operation status, tagged memory tally, runtime error message, page-pending active symbol, trend span, and others.

Mimic Configurator

Software package for designing/configuring the runtime mimics, i.e. graphics pages.

Mini-Trend

TREND graphic. Small window for runtime trending of up to three preselected realtime variables, with automatic vertical scaling and choice of three preassigned spans.

Mnemonic

Abbreviation of a parameter or function block name as displayed on the T1000 screen. E.g. EXPR (Expression block), PID (Control block), RemoteSP (Remote Setpoint parameter), LL_OP (Output Low Limit parameter).

Node

Position on a communications network (ALIN, LIN etc.) where an instrument is connected, having a unique node address.

Options Menu

List of items resident in the instrument from which the required one is selected, usually with the cursor. Menus can list block types, preset parameter values, operating modes, etc. Items not visible in the menu can be brought into view by auto-scrolling.

Page

See Graphics Page.

Page-Pending Facility

T1000 runtime facility that lets operators quickly screen one of eight graphics pages on a specified digital event (e.g. an emergency). Prioritisation copes with multiple event conditions and a flashing ! appears in the message bar warning when a page is 'pending'.

Parameter

Digital or analogue variable or group of variables within a function block, represented by a single mnemonic. E.g. PV (Process Variable), SelMode (Select Mode). *Read/write* parameters can have values written to them, but some — the *read-only* parameters — can only be monitored. Certain digital parameters are *write-only*, with transient values that always read back as logic zero. Many parameters can transmit or receive their values via block interconnections. *See also* Point.

Parameter Number

PNO. 7-bit number in the range 0 to 127 uniquely associated with a particular instrument parameter, used in binary protocol communications.

Parameterise

Assign values to the parameters in a function block or blocks, usually by entering values into their block Specification Menus.

Paste

Graphic Configuration: fix the position of a graphic object in a graphics page or window.

PID Control Algorithm

Iterative routine for calculating the output in control blocks using Proportional, Integral, and Derivative control. These terms refer to how the algorithm output responds to the error term size or rate of change.

Pixel

Smallest individual element of T1000's electroluminescent screen that can be lit or unlit to form part of a display. The screen is about 500 pixels wide by 250 high. The cursor X-Y co-ordinates displayed in the worksheet message bars are expressed in pixel units (0.4mm approx.).

Point

Individual parameter, or sub-parameter within a parameter group. Points corresponding to simple parameters are represented by the function block and parameter mnemonics separated by a period, e.g. **PID.PV**. Points contained in group parameters are represented hierarchically, e.g. **PID.Options.IntBalSL**. At runtime the value of a point can be monitored/altered via a linked dynamic graphic object, or via the block Specification Menu.

Pointing

Positioning the screen cursor at an object of interest using the wipe pad or mouse.

Pop-Up Menu

Options Menu that appears when a single item or parameter field is ENTERed, or a softkey is pressed. Some pop-up menus are 'nested' — press CANCEL repeatedly to close them up in reverse order.

Power-up display

Initial screen display seen when a T1000 (not configured with a Startup file) is switched on or cold started, consisting of the clock readout and RUN, CFIG (*not 'DISP' option*), and UTIL softkeys.

Querying

ENTERing a function block, wire icon, or graphic object during strategy configuration, with the ?? (Query) softkey activated, to access its parameters and other configuration information.

Remote

Communications Network: situated at a node other than the one currently being configured or under consideration. *See* Local.

Control Block: referring to an automatic control mode where the resultant setpoint SP derives ultimately from a parameter outside the control block (the remote setpoint SR). *See* Local.

Reset

Switch a digital parameter value or bit to logic zero, i.e. 'low'.

Reverse Video

Dark characters or detail displayed on a bright background field, instead of the usual T1000 bright detail on a dark background. Used to indicate a *highlighted* field, softkey, or other object.

Runtime

Time when a control strategy is running and possibly controlling plant.

Scroll

See Auto-scroll

Set

Switch a digital parameter value or bit to logic one, i.e. 'high', such that when the switching conditions are removed the parameter automatically resets. *See also* Latch.

Smart Card

Sealed credit-card-sized data storage unit that inserts into a DTU drive (in the T1000 or S9160 Interface) allowing transfer of files from one instrument or PC to another. The card storage medium is 32 or 128 Kb battery-backed RAM. Smart cards are also used as engineers' keys allowing access to certain operations.

Softkey

One of the set of 'keys' (labelled rectangles) displayed at the bottom of the T1000 screen which are operated by the corresponding set of field keys below the screen, labelled F1 to F8. Softkeys have functions that can vary with the operation being performed.

Span

Width of a trend plot in time units.

Specification Menu

Synonymous with *Template*. Table of function block parameters and their values, displayed on the T1000 screen, used to configure, monitor, and/or update values. Every function block has its own Specification Menu accessible during control configuration or at runtime.

Startup

Option in T1000's SETUP utility used to specify the control strategy that runs automatically after a T1000 cold start. This 'startup' filename is stored in the (EEPROM) CONFIG.SYS file.

Static Graphic

Graphic object that is of fixed appearance and cannot be used by the operator to interact with the control strategy. Often represents an unchanging part of a plant mimic, etc. E.g. POLYLINE, TEXT, ICON. (A dynamic graphic behaves as a static graphic if it is left unlinked to any point(s) in the strategy.)

Status Word

Parameter containing up to 16 bits (usually expressed as four hexadecimal digits), used to indicate/configure the status, operating mode or characteristics of a function block or instrument.

Strategy

See Control Strategy.

Sub-Point

One of a group of points in a multiple-point parameter. E.g. NotRem is a sub-point in the multiple-point parameter ModeAct in the PID block, and is expressed hierarchically as **PID.ModeAct.NotRem**.

T100 Configurator

Software package resident in a T100/LIN instrument, and accessed via a PC, used to configure the T100 directly as an alternative to downloading strategies from a T1000.

Tagged File

Filename marked by an arrow in the FILES Utility screen, on which filing operations generally act. Filenames can be tagged/untagged singly or in groups.

Tagname

8-character (max.) user-defined alphanumeric name given to a function block, in the *Block* field of its Specification Menu; defaults to "NoName". Strategies cannot be saved until every block has been given a tagname other than the default. In the control configuration worksheet the tagname appears on the block icon below the block *Type* name. (Tagnames can also be given to compounds.)

Template

See Specification Menu.

Trend

Plot of a parameter variable (vertical axis) against time (horizontal axis), either in realtime or historically. Realtime trends can be displayed at runtime via the TREND graphic ('mini-trends') or the Longterm Historic & Realtime trend package, which can also display historic trends.

UID

Unit Identifier. 4-bit number in the range 0 to 15 identifying a particular instrument within a group of instruments (at address GID) on an RS422 data bus. The UID and the GID (Group Identifier) together form the Instrument Number (INO).

Unit Controller

Synonym for the T1000 instrument.

Unit Identifier

See UID.

User Interface

Means by which operators and engineers interact with the equipment (displays, keys, software packages, etc.)

VDU Configurator

An ANSI standard terminal, comprising for example the TCS 8275 VDU package installed in an IBM™-compatible personal computer, used to access the T100 Configurator program resident in a T100 instrument.

Warm Start

Power-up after a relatively brief power break (less than the ColdStart parameter), when the current control strategy restarts with the existing parameter database and operating modes.

Wild

Referring to a selection procedure relying on only partial specification of the items required. E.g. all filenames with a common root can be tagged via the WILD softkey in the FILES Utility.

Window

See Graphics Window.

Wipe Pad

Environmentally sealed rectangular area at the lower right of the T1000 front panel, used to move the cursor around the screen display by rubbing the wipe pad surface with the fingertip in the required direction. An optical 'mouse' or an external 'trackerball' keyboard may be used as well as, or instead of, the wipe pad.

Wire

Interconnection between function blocks in a control strategy, represented on-screen by a line. A wire may contain several interconnections, i.e. represent a bus.

Worksheet

Area of the T1000 screen used to design control strategies and graphics pages. The Graphic Configuration worksheet is the same size as the screen, but only about 1/7th of the Control Configuration worksheet is visible at a time — 'auto-scrolling' lets you see the rest.

Write-Only

Referring to a digital parameter that can have a logic 1 written to it, but resets immediately after operation and therefore always reads back as logic 0. Write-only parameters usually have an initialisation or register-clearing action, e.g. the *ClearOv* parameter in the COUNT block.

Zoom

Longterm Trend: decrease a trend's plot range (by a factor of two), so increasing its vertical resolution, by pressing the IN softkey.

Compound Block: query a compound in Control Configuration and ENTER its Zoom field to reveal the blocks and wiring within.

INDEX